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Cause of Red Hardness of High-Speed Steel

New Facts and Theories—Changes Due to Heat Treatment X-Ray Crystal Analysis—Slip Interference

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THE high-speed steels considered in this article are essentially iron, tungsten, chromium and carbon alloys containing approximately:

	Per Cent
Tungsten	18.0
Chromium	4.0
Carbon	0.7

They are called high-speed steels because they can be used as cutting tools at a speed which produces a temperature corresponding to a dull red heat. The amount of metal which can be removed from the work by these high-speed steels in a given time is, therefore, much greater than that which could be removed by carbon steel tools which soften at a temperature far below that admissible for high-speed steel.

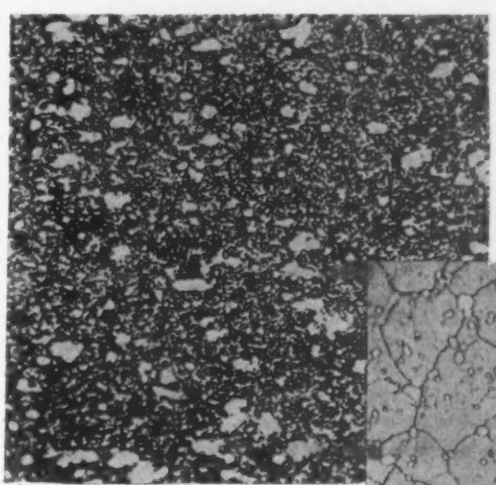

Fig. 1—High-Speed Steel, Thoroughly Annealed, x 500

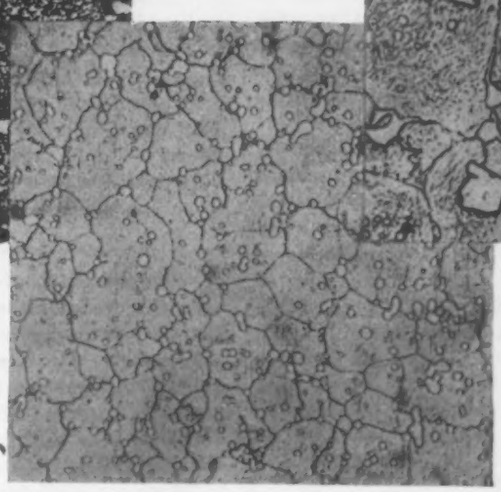

Fig. 2—(Below)—High-Speed Steel, Quenched From 2400 Deg. Fahr. (1300° C) in Oil, x 500

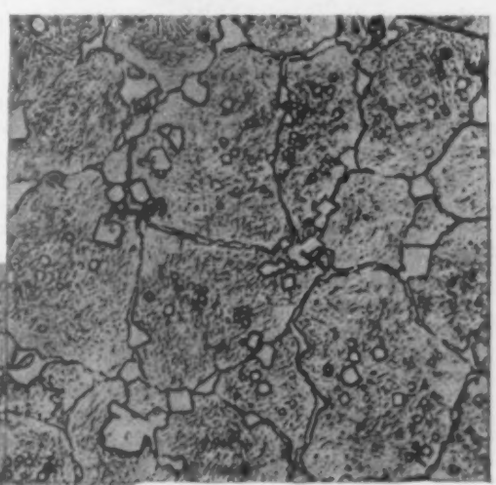

Fig. 3—High-Speed Steel, Quenched From 2400 Deg. Fahr. (1300° C) in Oil, x 1200

An average of 50 crucible high-speed steels shows the following composition:

	Per Cent
Carbon	0.67
Manganese	0.24
Silicon	0.28
Sulphur, less than	0.03
Phosphorus, less than	0.03
Chromium	3.99
Tungsten	18.36
Vanadium	0.96
Cobalt, practically nil.	
Nickel, practically nil.	

At the outset we may place manganese, silicon, vanadium, cobalt and nickel in a class of elements of secondary importance. Sulphur and phosphorus seem to be somewhat less harmful than in carbon steels, but nevertheless, in good practice they are kept quite low. Nickel is conceded to be detrimental to high-speed steel, and it is, therefore, somewhat surprising that extraordinary results are often cited in the special high-speed steels containing 3 to 4 per cent of cobalt. Vanadium, aside from its cleansing action seems to impart a certain additional hardness to high-speed steel and in recent years has been generally used in amounts of about 1 per cent. Although iron, tungsten and carbon might seem to be the chief elements of a steel possessing high temperature hardness, no high-speed steel is on the market which does not contain a substantial amount of chromium. Chromium is, therefore, to be classed as one of the more important elements of high-speed steels.

Steels exhibit good high-speed properties with the tungsten as low as 14 per cent. In European practice a tungsten content of over 22 per cent has been used. Perhaps over nine-tenths of the total tonnage of high-speed steel has a tungsten content between 16 and 20 per cent. These figures merely tend to emphasize the

fact that the thermal and mechanical history of a bar of steel is so much more significant than its composition (within certain limits) that the effect of small variations in composition is relatively unimportant.

Molybdenum can be substituted for tungsten, but so far it does not seem to have complied with all of the necessary factors for commercial success.

The same general procedure in melting, casting, cogging and rolling which produces a fine grained, clean and homogeneous steel of any other class must be applied in the production of high-speed steel. The ingot shows the usual columnar structure with carbide envelopes about the grains, so there must be sufficient mechanical working to refine the cast structure. After mechanical working and annealing, the microscope reveals a matrix of a sort of finely spheroidized pearlite made up of ferrite and globular particles of carbide. The carbide particles seem to vary greatly in size. A small percentage of the particles are large and give evidence of being primary carbide particles, whereas the smaller particles are apparently of secondary origin. That is, the large fragments have never been entirely in solid solution in the matrix at any stage of the previous working and heat treatment, whereas the smaller particles at some previous stage have been in solution in the matrix and have been precipitated during the anneal. This structure is shown in Fig. 1. There is no difficulty in differentiating, at least in extreme cases, between the primary and secondary carbides. This annealed high-speed steel is relatively soft and malleable. Most high-speed steel is delivered from the mills in this condition.

Changes Caused by Heat Treatment

In order to form a comprehensive idea of the changes taking place in high-speed steels during the various steps in heat treatment, the authors have considered the published work on microstructure, hardness, expansion and shrinkage, magnetic measurements, chemical behavior with reagents used as electrolytes, etching characteristics, and the spontaneous generation of heat at room temperature after quenching. The authors have supplemented the above information by the study of the crystal structure of the constituents of high-speed steel as revealed by X-ray crystallograms. The results of the X-ray examinations of high-speed steel are published here for the first time, although one of the authors has previously given a resumé of the information in lectures.

It is the purpose of the authors to set forth briefly the outstanding facts derived from the various methods of experimentation and to offer an interpretation of the cause of the high temperature hardness of high-speed steel. The authors have approached the problem from the standpoint of the basic and fundamental cause of hardness—slip interference[1]. In other words, high-speed steel is hard at a red heat because the slip interference is effective at a red heat. To discover possible sources of slip interference which persist at elevated temperature, let us consider the various properties as modified by heat treatment.

Microstructure

When high-speed steel of the average composition considered above is quenched from a temperature near that of incipient fusion, we obtain the structure as shown in Fig. 2. At low magnifications the polyhedral grains are almost structureless. Some undissolved carbide particles are seen to be present. Most of the carbide shown in Fig. 1 would be dissolved at a temperature near incipient fusion. The carbide particles shown in Fig. 2 are, therefore, residual particles. After re-annealing, these particles would be designated as primary in contradistinction to the smaller secondary particles. At higher magnifications there is visible a discernible structure within the polyhedral grains. We now know these grains to consist of a mixture of martensite and austenite. As the quenching temperature is lowered these grains etch more readily and the structure more nearly resembles that of carbon steel martensite. Upon quenching below 1800 deg. Fahr. (980 deg. C.) there is no microscopic evidence of the retention of austenite. The matrix etches so rapidly as to suggest the presence of troostite or sorbite.

In terms of the metallography of ordinary steel, high-speed steel at a temperature just above the A_{3-2-1} transformation is markedly hyper-eutectoid, that is, it contains a large excess of carbide. This carbide is more soluble in the matrix, the higher the temperature. All of the carbide does not go into solution in the matrix at any temperature at which the steel is completely solid. The higher quenching temperatures are, therefore, conducive to the solution of the maximum amount of carbide and hence to the retention of a minimum amount of residual carbide. The matrix contains more carbon and tungsten and chromium, the higher the quenching temperature. The quenched matrix, therefore, has different properties in accordance with its composition at the time of quenching. Apparently a high carbon-tungsten-chromium content of the matrix is conducive to the retention of austenite by quenching. Fig. 3, magnified 1200 diameters, shows the microstructure of the high-speed steel quenched from near incipient fusion. This steel is known to contain both martensite and austenite. Photomicrographs of high-speed steel are unsatisfactory for even qualitatively determining austenite.

Sauver[3] states that high-speed steel becomes much more resistant to etching the higher the quenching temperature. In one case an annealed steel was sufficiently etched in two minutes, whereas, after a high temperature heat treatment, an immersion of 14 min. in the etching solution was required. It is stated that the rate of etching in certain reagents can be used as an indication of the previous heat treatment. The carbides of either annealed or quenched high-speed steel are darkened by immersion in a solution of hydrogen peroxide and sodium hydrate. Fe_3C (ordinary cementite) is not darkened by this solution. This offers chemical evidence that the visible carbide in high-speed steel is not cementite. The development of a structure in high-speed steel, corresponding to globular pearlite in ordinary carbon steel, requires a temperature of about 1450 deg. Fahr. (790 deg. C.). In other words, it requires a higher annealing temperature to produce carbide particles of a given size in high-speed steel than in carbon steel.

Hardness

Measurements of hardness showing the effect of reheating temperature on specimens quenched at various temperatures have been made by a number of investigators. Fig. 4, taken from Scotts[3] work, gives the general information on these points. The increase in hardness observed after tempering at 1100 deg. Fahr. (595 deg. C.) on specimens quenched from 2100 deg. Fahr. (1150 deg. C.) and 2280 deg. Fahr. (1250 deg C.) is known as *secondary hardness*. It appears that very little secondary hardness is obtainable with a quench below about 1900 deg. Fahr. (1040 deg. C.). The potentiality for the development of secondary hardness increases with the quenching temperature above about 1900 deg. Fahr. (1040 deg. C.). It will be noted that there is a decrease in hardness on tempering at temperatures up to 950 deg. Fahr. (540 deg. C.). Recent and careful hardness measurements indicate that the hardness of quenched high-speed steel is reduced by tempering temperatures up to about 840 deg. Fahr. (450 deg. C.). If the quenching temperature is below about 1900 deg. Fahr. (1040 deg. C.) the hardness may be still lower

on tempering at 1100 deg. Fahr. (595 deg. C.) but it will probably not show a smooth curve through the tempering range 840 deg. Fahr. (450 deg. C.) to above 1100 deg. Fahr. (595 deg. C.). In other words, there will either be a halt in the rate of hardness reduction at a tempering temperature near 1100 deg Fahr. (595 deg. C.) or an increase in hardness depending upon the previous heat treatment.

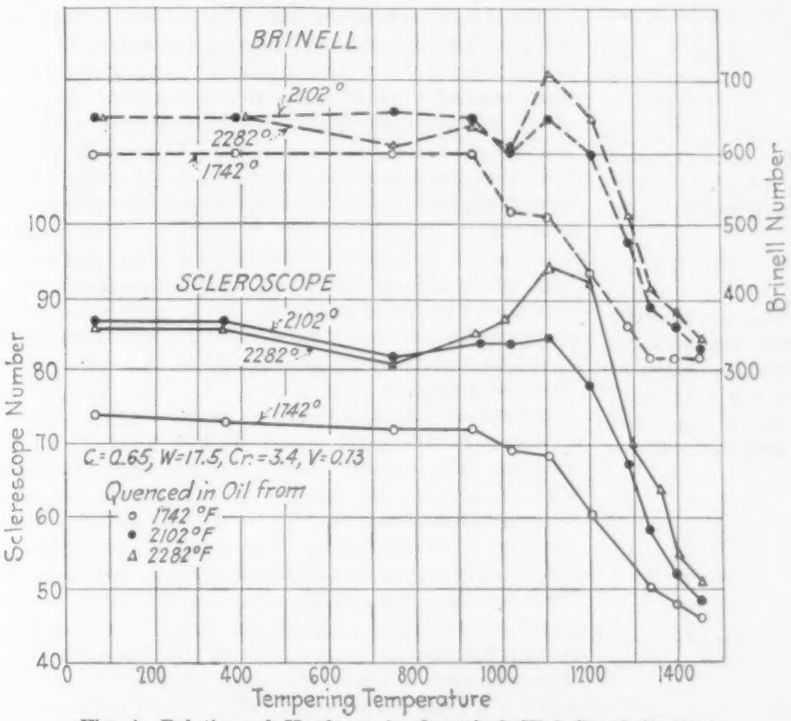

Fig. 4—Relation of Hardness in Quenched High-Speed Steel to Drawing Temperature.—Scott

If the quenching temperature is slightly below about 1900 deg. Fahr. (1150 deg. C) there will be a local rise in the hardness-tempering curve corresponding to the secondary hardness, but the value obtained by tempering at 1100 deg. Fahr. (595 deg. C.) may not be so high as that obtained before tempering. With quenching temperatures above about 1900 deg. Fahr. (1150 deg. C.) the hardness after secondary hardening may be greater than the hardness before tempering. The secondary hardening effect reaches a maximum with short time of tempering at about 1100 deg. Fahr. (595 deg. C.).

It should be mentioned that the decrease in hardness occasioned by tempering up to 840 deg. Fahr. (450 deg. C.) is not always gradual, and often a small hump in the curve toward a maximum has been observed at about 575 deg. Fahr. (300 deg. C.). This hump is strongly marked in the special high-speed steels containing cobalt and is encountered in high chromium steels containing no tungsten, there being, of course, no maximum at the higher temperature in this latter type of steel. This slight discontinuity in the hardness-tempering relations is somewhat more pronounced after quenching from relatively lower temperatures.

Expansion and Shrinkage

Throughout this discussion, the authors have deliberately avoided the mention of time in any of the heat-treating schedules; this has been done in the interests of simplicity, and because of the variations in individual practices, but it is safe to assume that 30 min. at drawing temperature would duplicate the results of the averages recorded by the authors.

Interesting results on the linear change of dimensions of high-speed steel under various conditions have been reported by Grossmann[4]. The results are in qualitative accord with those published by Edwards[5], and by Gill and Bowman[6]. If the linear dimensions are plotted directly, or density inversely, with drawing temperature the curves very much resemble the hardness tempering curves, as may be seen in Fig. 5. The steel expands on quenching, the expansion being greater the higher the quenching temperature up to 2300 deg. Fahr. (1250 deg. C.). With successively higher tempering temperatures the steels contract and the density increases up to about 800 deg. Fahr. (425 deg. C.). Beyond this temperature expansion sets in, the volume reaching a sharp local maximum at about 1100 deg. Fahr. (595 deg. C.). Above 1100 deg. Fahr. (595 deg. C.) the density again increases. A final draw at about 1500 deg. Fahr. (815 deg. C.) restores the approximate original density of the annealed bar.

Magnetic Measurements

Honda[7] has made preliminary studies on the magnetism-temperature relations of high-speed steel. He has determined the presence of cementite in high-speed steel by means of the reversible magnetic transformation which occurs in cementite at about 430 deg. Fahr. (215 deg. C.). He has also noted an additional reversible transformation at about 750 deg. Fahr. (400 deg. C.) which he attributes to the double carbide of iron and tungsten. This latter transformation is weaker than the cementite transformation and practically disappears with certain heat treatments.

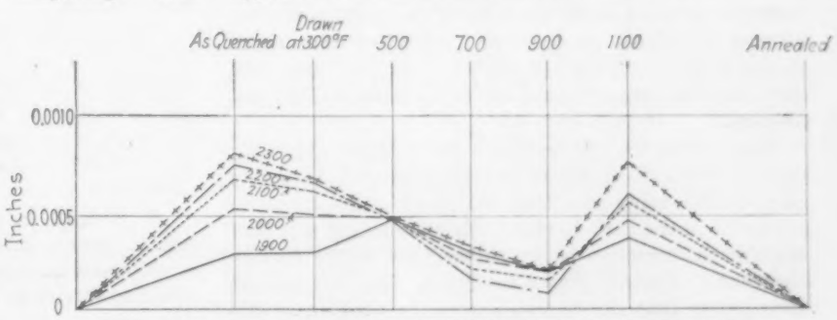

Fig. 5—Change in Dimensions of High-Speed Steel with Drawing Temperatures.—Grossmann

With reference to experiments on the magnetization of high-speed steel it has been observed[8] that in steels quenched from a high temperature the maximum induction drops below 4000 gausses. Reheating increases the value slowly until a temperature of 930 deg. Fahr. (500 deg. C.) is reached. Tempering above this point rapidly restores the magnetization to the value found for thoroughly annealed steel.

Electrolytic Corrosion

When a completely annealed specimen of high-speed steel is made annode in a dilute acid solution nearly all of the ferrite can be removed without dissolving the carbide particles. One of the specimens treated by one of the authors retained the original shape of the

specimen until nearly three-quarters of its weight had been removed. The residual carbide falls to powder when thoroughly dried. Great care is necessary to wash the carbide completely and then dry it without atmospheric attack. This powdered carbide was first prepared to obtain a sample for the X-ray examination. A sample of this carbide was analyzed and gave results shown in the first column of the following table:

	Analysis of carbide Residue by Smith [9]	Analysis of carbide Residue by Arnold
Carbon	2.5	2.33
Iron	28.1	23.96
Chromium	6.5	3.13
Tungsten	60.1	64.24
Vanadium	2.8	4.81

An analysis of a similar residue has been reported by Arnold and is given in the second column. Both of the above samples were obtained from annealed high-speed steels.

In the course of the decomposition of the steel in the dilute hydrochloride acid the tungsten, if in a condition to be attacked, is converted to insoluble tungstic acid. Sometimes the precipitation does not seem to take place at once, but instead, a colloidal solution of the tungsten results. However, this is not persistent, and the final filtrate is free from tungsten. This yellow precipitate is, of course, mingled with carbides and can

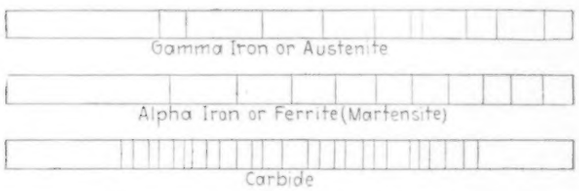

Fig. 6—The Crystallogram Lines of the Three Principal Constituents of High-Speed Steel

be separated by solution in ammonia. It is very interesting to note that the carbides from thoroughly annealed high-speed steel show only a very slight (about 2 per cent) loss by this ammonia treatment. On the other hand, carbide residue from freshly quenched high-speed steel, shows a different result. In this case as much as 33 per cent of the carbide residue mixture is soluble in ammonia, indicating that about 26 per cent of all the tungsten in the steel had been converted to tungstic acid by the electrolytic decomposition.

Tests show that the carbides are at most only very slightly attacked by dilute hydrochloric acid, hence we may be reasonably sure that nearly all of the tungsten is located in the carbide phase after annealing and that much of the tungsten is in another form in the freshly quenched or slightly drawn condition. The inference is very strong that the tungsten must be atomically dispersed, or at least in an extremely fine state of aggregation, in order to form the tungstic acid in the hydrochloric acid solution.

Spontaneous Generation of Heat in Quenched Condition

C. F. Brush[10] has water-quenched high-speed steel from a temperature not far below fusion and within an hour after the quenching has observed a temperature change in the steel when placed in a sensitive calorimeter. He performed many similar experiments with high carbon tool steels and found a generation of heat which persists to a measurable extent after several weeks. There was a contraction accompanying the heat generation in the tool steel. It is assumed that a contraction would take place also in the high-speed steel at room temperature. Dr. Brush remarks: "It is seen that heat generation in the tungsten steel is the same in character as in the carbon steel . . . although much less in amount and somewhat more persistent." The authors would infer that the spontaneous shrinkage would be less than in the carbon steel also.

X-ray Crystal Analysis of High-Speed Steel

By means of crystal analysis[11] carried out along the lines of the Hull method, it has been shown that iron having the body-centered cubic arrangement of atoms at low temperature undergoes an atomic rearrangement at the critical range and changes to the face-centered cubic crystal lattice. The patterns of the diffraction lines recorded on a photographic film are very distinctive for these two crystal types. The changes from austenite (face-centered cubic atomic arrangement) to ferrite (body-centered cubic atomic arrangement) may be very easily followed. In the case of carbon steel, the cementite present does not yield a pattern strong enough to reveal its presence or disappearance with either gamma iron or alpha iron as a matrix. However, the carbide of high-speed steel contains a high percentage of the heavy tungsten atoms and is, therefore, capable of producing X-ray patterns at least when present in considerable amounts, and in particles of a size corresponding to about 50 or 75 atomic layers (0.0000015 cm.).

Annealed high-speed steel as shown in Fig. 1 shows a strong ferrite pattern and slightly weaker carbide pattern. The carbide pattern is the same, however, as that obtained by the use of isolated carbide particles obtained from electrolytic decomposition. When the steel is quenched from successively higher temperatures, beginning at about 1470 deg. Fahr. (800 deg. C.) the intensity of the carbide pattern gradually decreases. At about 2350 deg. Fahr. (1290 deg. C.) the carbide pattern becomes so faint that it is scarcely discernible. When the steel is quenched from 1900 deg. Fahr. (1040 deg. C.) a faint face-centered cubic crystal lattice is revealed proving the retention of austenite. The intensity of the austenite lines in the crystallogram increases and the intensity of the ferrite lines decreases as the quenching temperature is raised above 1900 deg. Fahr. (1040 deg. C.). High-speed steel quenched from about 2350 deg. Fahr. (1290 deg. C.) shows both ferrite and austenite patterns (as suspected by Scott) well developed with the ferrite pattern being only slightly more intense.

The austenite retained on the quench is very resistant toward martensitic transformation. A specimen was repeatedly immersed in liquid air without causing the austenite to transform to martensite. Twenty cycles of temperature change from room temperature to —310 deg. Fahr (—190 deg. C.) failed to have any observable effect on the austenite content of the steel.

A sample quenched from 2350 deg. Fahr. (1290 deg. C.) shows such a faint carbide pattern that it may be regarded as essentially a ferrite-austenite combination, the ferrite in this case being, of course, of martensitic nature. Furthermore, when quenched steel is reheated about 16 hr. at 950 deg. Fahr. (515 deg. C.) the austenite changes to martensite and the carbide particles have not yet reached a sufficient combination of size and number to produce an effective X-ray pattern. A steel so treated shows essentially a ferrite pattern. Heating for a moderate time at 1200 deg. Fahr. (650 deg. C.) increases the intensity of the carbide pattern. The pattern lines as recorded on the crystallogram for the three principal constituents are shown in Fig. 6.

In spite of the fact that the literature is full of reports indicating the existence of several carbides, the authors have found only one carbide pattern in annealed high-speed steel. This pattern is too complicated to decipher at the moment in order to construct the space lattice, but it is distinctive and unlike Fe_3C, W_2C or FeW. The X-ray results indicate that the stable carbide is the iron-tungsten carbide which no doubt is capable of retaining varying amounts of chro-

mium and vanadium without changing the type of crystalline lattice.

General Considerations and Conclusions

From all of the above facts, the authors have arrived at certain conclusions regarding the changes taking place in high-speed steel with various heat treatments and offer an interpretation as to the cause of the red hardness of high-speed steel. Many of the statements enumerated below are well known and corroborated by many investigators, while others are believed to be new:

1. Ordinary high-speed steel contains sufficient carbon, tungsten, and chromium to be classed as a markedly hypereutectoid steel. There is a considerable amount of excess carbide at a temperature just above the A_{3-2-1} transformation. This fact is demonstrated clearly by microscopic examination and is typically shown in Fig. 1. While contemplating the behavior of high-speed steel, it may be well to bear in mind that the metallic atoms of the elements are present in the ratio of about 140 iron, 10 tungsten, 10 chromium and vanadium together and 6 carbon. That is to say, in an entirely representative cube of 10 atoms on the cube edge, we would have about 840 iron atoms, 60 tungsten atoms, 60 chromium and vanadium atoms and 36 carbon atoms.

2. The excess carbide is more soluble in the austenitic matrix, the higher the temperature. The greatly reduced quantity of carbide shown in Fig. 2 gives sufficient evidence of this point.

3. The amount of alloying elements in ordinary high-speed steel is sufficient to form more carbide than is soluble even at incipient fusion of the steel. This fact is demonstrated by microscopic examination after quenching high-speed steel from incipient fusion.

4. At temperatures appreciably above the lower critical point only one crystal structure in the carbide is present. This carbide is essentially an iron-tungsten carbide, but no doubt contains varying amounts of vanadium and chromium with the retention of the same type of crystal structure. This ability to retain crystalline structure intact with change in composition is an outstanding property of intermetallic compounds. It is, of course, conceivable that with certain chemical composition the carbon and tungsten would be present in such proportions that either of them might be substantially used up in the formation of the iron-tungsten carbide and leave an excess of the other element. In such a case an additional compound would be expected to form when conditions permitted. It is also submitted that the iron-tungsten carbide is the most stable carbide in high-speed steels above about 1100 deg. Fahr. (595 deg. C.).

5 As the iron-tungsten carbide dissolves in austenite at high temperatures, the constituents of the carbide, no doubt, are dissolved in the austenite as individual atoms. The evidence against the existence of the intermetallic compound as such in solution in a space lattice has been considered at length in the literature cited. Before the quench the high-speed steel consists of some residual, undissolved iron-tungsten carbide embedded in a matrix of austenite which contains a considerable proportion of the tungsten, carbon, chromium and vanadium in solid solution.

6. The quenching of the high-speed steel leaves the residual carbide particles unchanged and produces varying amounts of martensite in accordance with the quenching temperature and the remainder persists as austenite. Freshly quenched high-speed steel, therefore, consists of a small amount of iron-tungsten carbide and the remainder is composed of martensite and austenite in both of which the atoms other than iron are atomically dispersed. Grain growth in the austenitic matrix of high-speed steel at the quenching temperature is profoundly discouraged by the presence of the residual carbide particles.

7. Some of the austenite which exists at the high temperature changes during the quench to martensite. The amount of austenite which remains unchanged varies with the temperature of the quench, the higher the quench the greater the proportion of austenite. This is probably due in part to the greater solubility of carbon, tungsten and chromium in gamma iron at higher temperatures—these elements acting to restrain the conversion.

8. In the martensite portion of the freshly quenched material, the only atoms which can migrate easily at room temperature or a little higher are the carbon atoms. In all probability the tungsten atoms are held in fixed positions in the iron lattice, and likely this is true also of chromium and vanadium. Iron atoms are available on every hand for combination with these carbon atoms; hence, even at room temperature Fe_3C begins to form. The heat of formation of Fe_3C is probably the heat evolution observed by Brush.

9. At progressively higher temperatures the chromium and vanadium will be capable of diffusion in the ferrite space lattice and carbides will form. The crystalline structure of the ferrite becomes more perfect and the carbide particles grow by coalescence to a super-critical size so as to soften the martensite at 850 deg. Fahr. (450 deg. C.). The carbide precipitation in the order of availability of atoms accounts in a large measure for the softening, heat evolution, shrinkage and magnetic point. The order of atomic volumes from smallest to largest of the principal elements involved is—C, Fe, Cr, Va, W.

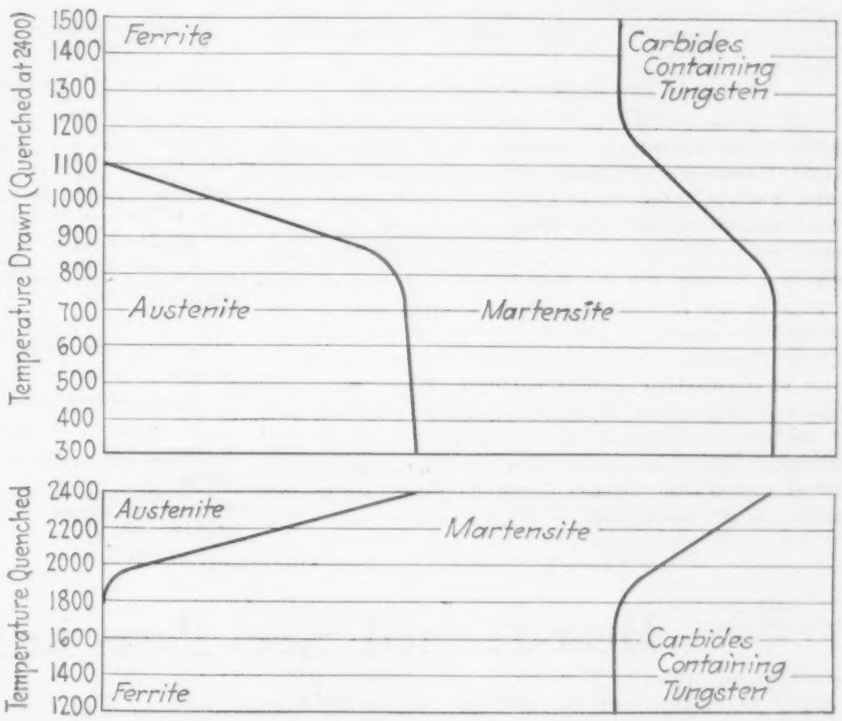

Fig. 7—The Relative Proportions of the Principal Constituents (Abcissae) of High-Speed Steel After Various Treatments (Ordinates)

10. At about 850 deg. Fahr. (450 deg. C.) the larger tungsten atoms are capable of slight diffusion and at this temperature the formation of carbides will follow the order of carbide stability in preference to the sequence of atom availability. Iron-tungsten carbide is the most stable one and forms to the elimination of the earlier formed carbides.

11. The iron-tungsten carbide particles reach approximately the size for critical dispersion after a short reheat at 1100 deg. Fahr. (595 deg. C.). Within the grain growth temperature range carbide particles are present to obstruct the growth and hence the grains of the matrix are not permitted to grow excessively. It is the combination of retention of small grains and precipitation of the tungsten-iron carbide particles in critical size at 1100 deg. Fahr. (595 deg. C.) which accounts for the red hardness in high-speed steel.

12. The austenite present after the quench may not undergo any change important to the physical properties of the steel up to the temperature of martensite transformation at from 850 deg. Fahr. to 1100 deg. Fahr. (450 deg. C. to 595 deg. C.). Some excess cementite (Fe_3C) may precipitate from austenite below this temperature, but if so, we would regard it as only an incidental feature.

13. Between 850 deg. Fahr. and 1100 deg. Fahr. (450 deg. C. and 595 deg. C.) the austenite transforms into martensite with expansion and increase in hardness. At

this temperature the iron-tungsten carbide can form, and does form, in critical dispersion. Its presence helps to keep the grain size of the new martensite small and to key the slip-planes of the ferrite grains.

14. As the temperature is raised above 1100 deg. Fahr. (595 deg. C.) grain growth of ferrite and particle growth of the iron-tungsten carbide produce rapid softening similar to the corresponding process in carbon steel at lower temperatures. Fig. 7 is a chart which is intended to show the change in relative proportion (abcissae) of the constituents of high speed steel with heat treatment (ordinates). It should be noted that the cementite, Fe_3C, is included in the martensite (ferrite) area and that only the change in amount of the characteristic stable iron-tungsten carbide is indicated.

15. The double carbide contains its atoms in a relatively dense state. When double carbide dissolves in austenite the density of the steel is lowered and when double carbide precipitates, the density increases. There is also the usual decrease in density when austenite changes to martensite. This is largely due to the lower density of alpha iron as compared to gamma.

Cause of Red Hardness Briefly Stated

The cause of the red hardness of high-speed steel might be briefly stated as follows: The changes which cause martensite of carbon steel to soften are grain growth of the ferrite and growth of the carbide particles above critical size. Similar changes in high-speed steel take place only at a red heat. The outstanding reasons for the retention at red heat of fine grains in the ferrite of high-speed steel are the increased resistance to growth due to the elements in atomic dispersion in the ferrite and the copious presence of obstructing carbide particles. The reason for retention at red heat of carbide particles of critical size is the great stability of the iron-tungsten carbide and the large size of the tungsten atom. The great stability of this double carbide forces its formation to the exclusion or elimination of other carbides when the necessary atoms are available. The large size of the tungsten atom prevents its diffusion in the ferrite space lattice until a temperature corresponding to a red heat is reached. The double-carbide is an intermetallic compound which owes its existence entirely to crystallization. The formation of a particle of this carbide, therefore, requires a number of tungsten atoms which must be supplied by diffusion through the ferrite lattice. The precipitation and growth of the double carbide in quenched high-speed steel at a dull red heat is, therefore, somewhat comparable to the precipitation and growth of cementite in quenched carbon steel below 300 deg. C.

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9. Analysis furnished by Oscar R. Smith, chief chemist, Atlas Steel Corporation, in connection with unpublished work of Grossmann and Bain.
10. C. F. Brush, "Some Thermal Relations in the Treatment of Steel." *Trans.* A. I. M. E. Pyrometry Volume, 1920, p. 590.
11. "Studies of Crystal Structure with X-rays." Edgar C. Bain. *Chem. & Met. Eng.* Oct. 5, 1921, p. 663. Dr. Arne Westgren independently obtained the same information in Sweden.

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Heat-Treated Steel Parts in Service

Effect of Long-Time Drawing Conditions or Further Heat Treatment Under Use—Stability of a Steel

BY GEORGE K. ELLIOTT*

As commonly understood, heat treating consists of passing a metal or alloy through one or more changes of temperature for the purpose of imparting to it definite physical properties. Applied to steel it generally involves raising the temperature of the steel to some point above its critical temperature and cooling in some way so as to reach eventually a room temperature. If the cooling be conducted slowly, the process is known as annealing; if rapidly, it is called hardening, the degree of hardening being determined largely by the amount of carbon in the steel and the speed of cooling. All this is a matter of elementary knowledge to heat treaters.

Hardening usually is paralleled by an increase in strength, elastic limit and brittleness, which last property customarily calls for a supplementary treatment in the form of tempering or heating to a relatively low temperature and cooling, for the purpose of decreasing it to a safe degree.

Hardened Steel Is Unstable

The writer wishes to dwell upon the fact that steel in the hardened condition is often unstable and readily slips back to some form of greater stability whenever its existing temporary equilibrium is disturbed by an increase in temperature. Especially is this true of carbon steels and of alloy steels of a relatively mild nature which may be classed as "near" carbon steels.

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Rudimentary as this fact is to the metallurgist, it has been found to lie beyond the pale of knowledge of not a few engineers who design mechanical devices and specify materials for them. They overlook the fact that under certain working conditions a treated steel may automatically undergo further heat treatment in service with possible harmful results.

Here reference is made to modern industries which are adopting a number of processes and practices which demand higher temperatures than formerly could sanely be even hinted at; frequently these in addition involve rather severe working stresses. In order to meet these stresses we occasionally find engineers specifying steels and strengths in the steel that are attainable only through a hardening heat treatment. Attention should be called to the fact that such treatment is liable to leave the steel in a more or less unstable condition. If a steel thus treated be exposed for long periods of time to temperatures of 600, 800 or 1000 deg. Fahr., there is a dangerous possibility that it may take advantage of the circumstance and recede to a more stable state with a corresponding decrease in physical properties. Therefore it would seem safer for the engineer to figure on using his steel for high temperature, in its most stable form, the form least susceptible to thermal influences.

In order to accomplish this at least two roads lie before him—either he can stick to the carbon steel with which he is best acquainted, have it in a thoroughly annealed or normalized condition, and design

the steel parts accordingly heavier; or if he desires to reduce to a minimum the weight of his structure, he must look for some alloy steel which, in its most stable state, will have the needed physical properties.

A piece of steel that has been heated above its critical point, quenched and drawn at perhaps 800 deg. Fahr. may seem to the casual inquirer to be permanent enough for service under stress and at 800 deg. temperature, but if it be considered that the service perhaps will extend through months and even years there arises a grave doubt that the cumulative effect of time and temperature will not sooner or later effect a "drawing" of the steel which will be much more drastic than would be deduced from the temperature alone.

Demand for Steel Used at High Temperatures

The petroleum industry, ultra-modern high pressure and temperature power plants, and several chemical processes are creating a demand, limited as yet but growing, for steel parts which will withstand high pressures at temperatures of 600, 800, 1000 deg. Fahr. and perhaps higher, and the metallurgical engineer must heed very carefully the material that is supplied to these wants. Especially does it seem important that the steel used be of such composition and in such state as to be of maximum stability under the thermal conditions of the service.

It seems highly desirable that extensive investigations be made concerning the true effect of long-time drawing at moderate temperatures of carbon and alloy steels which have first been submitted to a variety of heat treatments. These tests would involve exposing the test samples for many months at various industrially important temperatures and noting the effect upon the physical properties; for example, one series of tests might be conducted at 400 deg. Fahr., and others at 600, 800 and 1000 deg. At higher than 1000 deg. the drawing completes itself much more rapidly so that the results either are already known or are more readily predicted.

It is now known that drawing a steel at 350 deg. for a long time will give approximately if not exactly the same results as drawing at 450 deg. for a much shorter time, but metallurgical literature does not yield much information as to whether drawing at 350 deg. can be prolonged sufficiently to attain results equal to drawing at 800 or 1000 deg. for a short time. In other words there is need of knowledge as to how far various commercial steels and others can proceed toward greater stability when exposed to any of the moderate temperatures just mentioned and how the physical properties are affected by the stabilizing.

The question of stability at these temperatures also embraces a study of alloy steels. In fact there seems to lie the greatest promise of a solution because it is well known that many of the alloying elements such as nickel, chromium, manganese, etc., have an effect upon the thermal properties of steel which serves toward greater stability.

Some Causes for File Steel Failures

Suggested Means for Prevention—Conditions Prevailing in the Rolling, Forging and Heat Treatment of the Steel

BY ARTHUR W. F. GREEN*

FILE steels are made in the crucible, electric and open-hearth furnaces. The relative merits of the products of these three steel-making processes are not to be discussed. The purpose of this paper is to describe briefly and illustrate some of the causes for failure in files made from carbon steel, and to suggest possible means for their prevention.

File steels made from carbon steel have a carbon content ranging from 1.10 to 1.40 per cent, the average being about 1.35 per cent. File steel as cast has a structure as shown in photomicrograph Fig. 1, which shows plainly the free cementite both as the network around the grains and as needles within the grains. (All photomicrographs are X150 and etched in 10 per cent nitric acid.) Steel containing so high a percentage of carbon is not a particularly hard material to make in no matter what kind of furnace employed, but, because of that fact, it sometimes happens that usual care is not exercised. A wild heat or one that is not correctly handled may cause material to be made that will not be uniform, in that there will be areas of carbon segregation with the result that files made from the steel will not be uniformly hard.

Some idea of the way in which carbon segregates can be seen in photomicrograph, Fig. 2. This shows the carbon segregation around a blow hole in a large ingot of crucible steel. The heavy white network being free cementite. Photomicrographs, Figs. 3 and 4, show two sections taken from the same file, which failed to pass inspection because of lack of uniform hardness. In Fig. 3 a hard spot is shown in the tooth, while in Fig. 4 the tooth was soft as shown by the troostitic structure, and the lack of free cementitic globules. It will also be noted that the top of the tooth shown in Fig. 4 is burred over. This occurred when the file was tested. The failure was due primarily to carbon segregation.

Another cause for failure of files due to improper melting conditions is slag inclusions. Defects of that kind may cause soft spots, and very often cracking during quenching for hardening. Photomicrograph, Fig. 5, shows a slag inclusion in a file which broke in harden-

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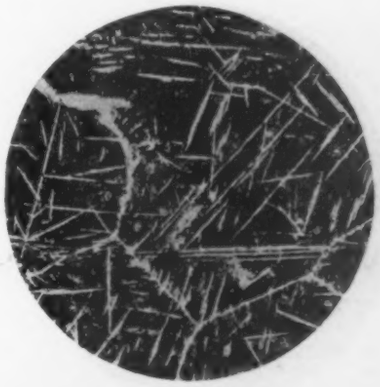

Fig. 1

Fig. 2

Fig. 3

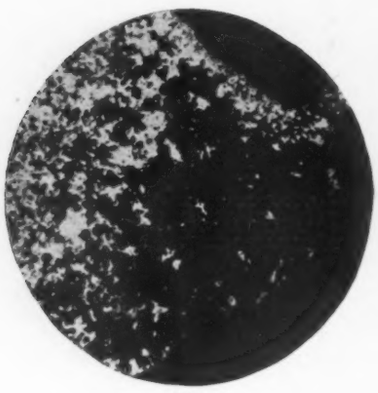

Fig. 4

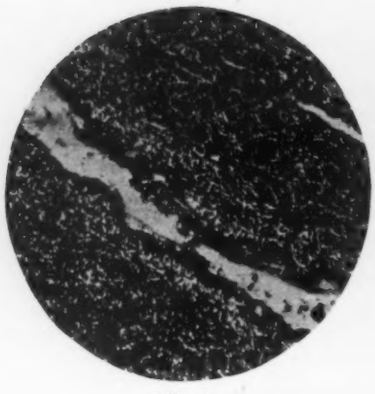

Fig. 5

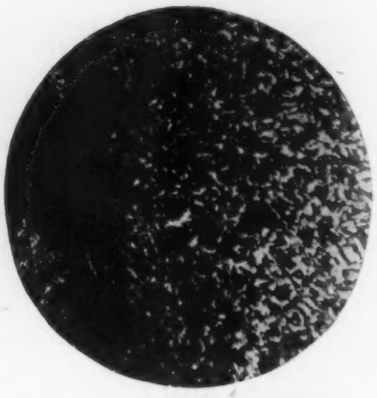

Fig. 6

ing. Carbon segregation around the inclusion may be easily seen.

The rolling of file steel into the various commercial shapes does not give rise to any unusual conditions, and with proper care in heating, coupled with correct roll design it is possible to produce rolled flats or tapers that will meet the most exacting needs. However, there is one problem that faces all file steel manufacturers, and that is decarburization of the steel. Because of the high carbon of the material, this is an easy condition to produce, especially where little attention is given to furnace atmospheres, etc.

Photomicrographs, Figs. 6, 7 and 8, show some phases of decarburization of file steel. Figs. 6 and 7 were made from the same piece of steel. In Fig. 6 is shown the surface of the piece. Practically no carbon remains on the surface. Going in from that point the carbon content gradually increases until a wide area is reached containing 0.8 per cent to 0.9 per cent carbon. This eutectoid area is several thousandths of an inch wide, and is distinguished by the lack of either free iron or cementite.

The true condition of the steel is shown in Fig 7. File steel decarburized as deeply as that just described is useless, since it would be necessary to grind so great an amount from the surface to render the file usable that the cost of grinding alone would be prohibitive, as well as making the piece too small. Photomicrograph, Fig. 8, shows the decarburized edge of a rolled file steel, which is not as bad as that shown previously. However, because of the width of the eutectoid area it would be difficult to produce good files without doing a great deal more grinding than usual. Photomicrograph, Fig. 9, was made from a bar of file steel showing normal decarburization from rolling. Since all file manufacturers count on grinding several thousandths of an inch from all file blanks before cutting and hardening, such decarburization is not serious.

Mill decarburization can best be regulated by keeping as nearly as possible a reducing atmosphere in the furnace used for heating, and also by designing the rolls so as to give as great a number of scaling passes as is possible. The mill in which the writer is employed has been quite successful in combating decarburization by installing oil-burning furnaces using low-sulphur oil, and by using specially designed rolls.

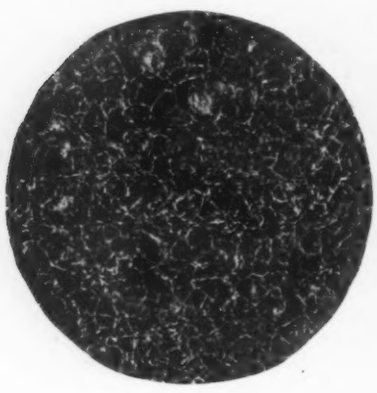

Fig. 7

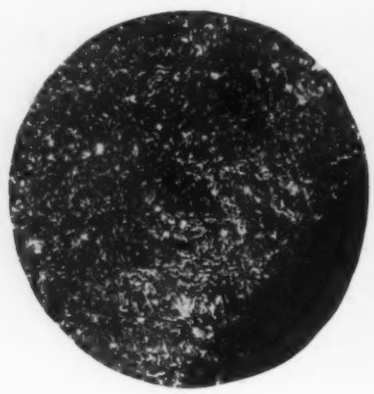

Fig. 8

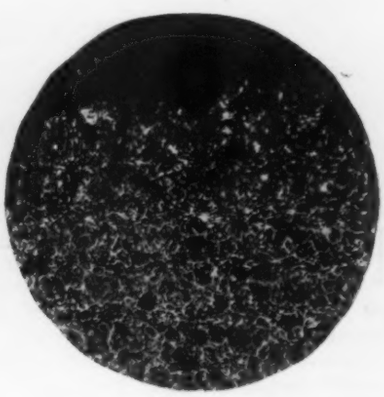

Fig. 9

It is not to be assumed from the foregoing that all the failures of file steel are to be laid at the door of the mill producing steel. Very often the cause or causes for failure of files occur in the file manufacturers' shops.

Many files are doomed for failure and the manufacturer's scrap heap because of lack of control of the temperatures used for forging the tang and shaping

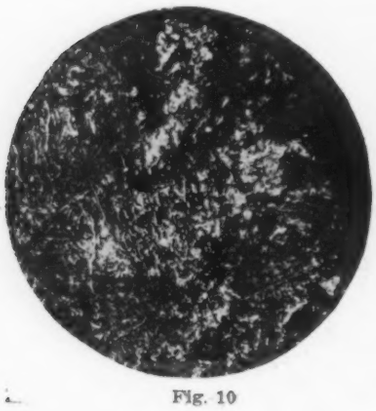

Fig. 10

Fig. 11

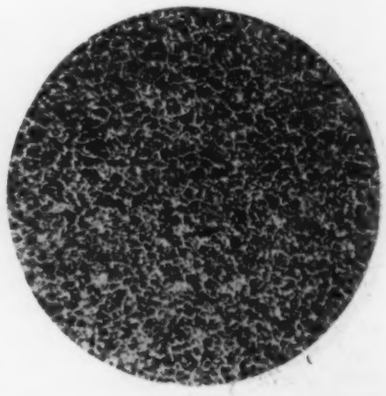

Fig. 12

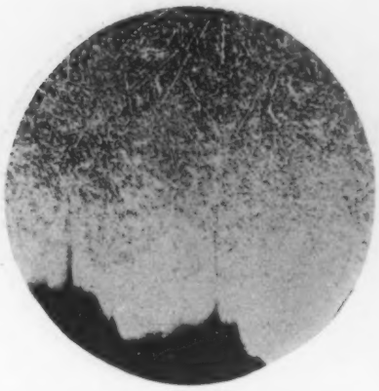

Fig. 13

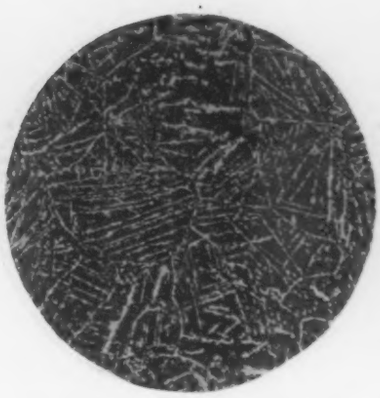

Fig. 14

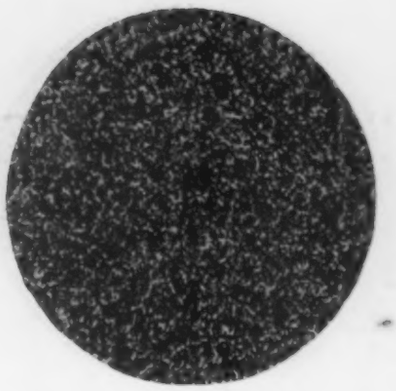

Fig. 15

the file. Most of that work is done on a piece work basis. Consequently, the workers very often feel that by using high temperatures they can produce more work, because it has been heated quickly. The results of too quick and too high heating may be seen by referring to photomicrographs, Figs. 10 and 11, Fig. 10 showing the edge of the sample severely decarburized, and Fig. 11 the structure of the steel near the center of the piece. This is in contrast with the structure shown in photomicrograph, Fig. 12, taken from a section of the unforged end of the same piece of steel. Material so mistreated and then made up into files will result in the files being brittle and very often cracking during quenching. The structure of the forged end poorly worked and then hardened is shown in photomicrographs, Figs. 13 and 14.

The use of correct forging temperatures usually improves the structure of the part of the file worked. This is shown in photomicrographs, Figs. 15 and 16. It will be noted that the grain is smaller and more refined in the forged section shown in Fig 15 than in the unforged section shown in Fig. 16.

The annealing of the file blanks after the tang has been forged and the pieces properly shaped by forging or rolling is a process which, in the writer's experience, is carried on in a different way in each shop. Some manufacturers anneal by packing the blanks in suitable boxes that can be readily sealed to keep out air and furnace gases. Charcoal or other carbonaceous material is sometimes added to the charge in the box to guard against decarburization. Some anneal successfully by tying a number of blanks into bundles and placing a number of bundles in the furnace at the same time. Others merely pack the furnace with loose blanks. It has been found that wood, coke, oil, coal, gas and electricity are used for fuel for the annealing furnaces.

One shop using a method of packing the blanks in the furnace without protection, experienced great difficulty in producing good files, and examination disclosed that those files which had formed the upper layer and sides of the bundle had been severely decarburized. A section from one of the blanks is shown in photomicrograph, Fig. 17. A great deal of grinding was done, but even then the files would come from the hardening with soft spots. This can be readily understood by noting the way in which the free cementite had segregated to the grain boundaries while the amount of spheroidized cementite within the grains gradually decreased and only normal pearlite remained.

Photomicrograph, Fig. 18, shows the decarburized edge on a file blank after having been ground in the usual way. This blank had been annealed in an old

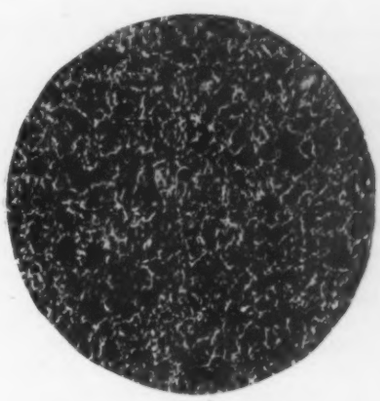

Fig. 16

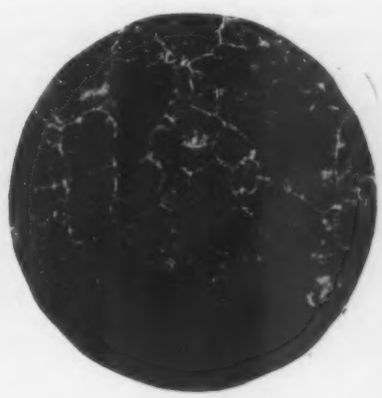

Fig. 17

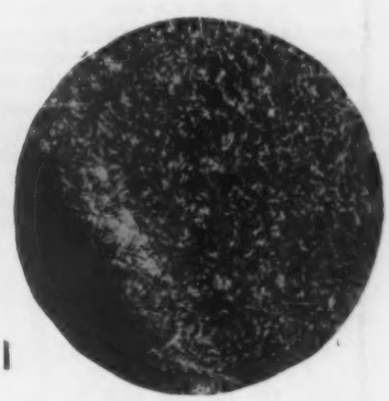

Fig. 18

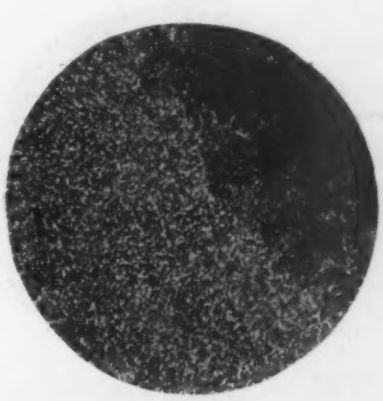

Fig. 19

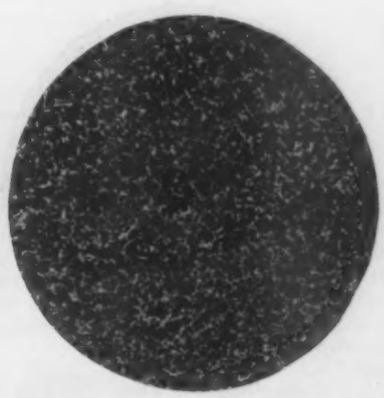

Fig. 20

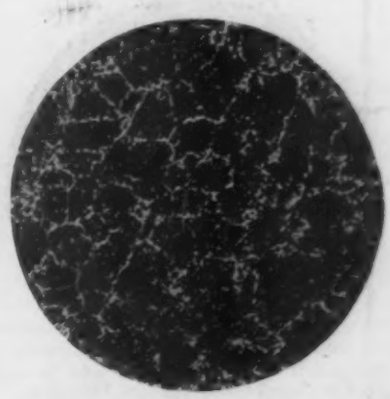

Fig. 21

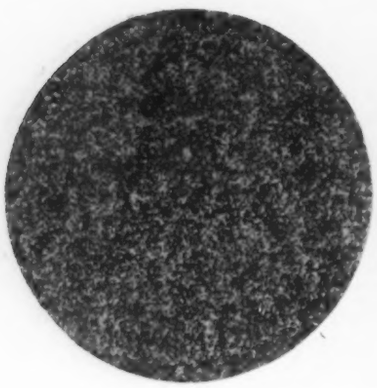

Fig. 22

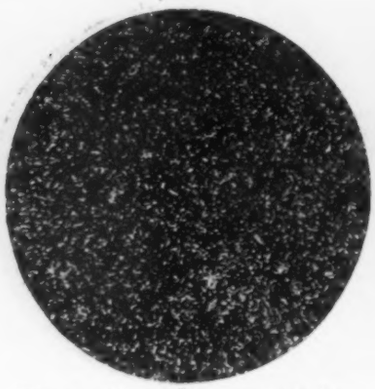

Fig. 23—Quenched From 1400 Deg. Fahr.

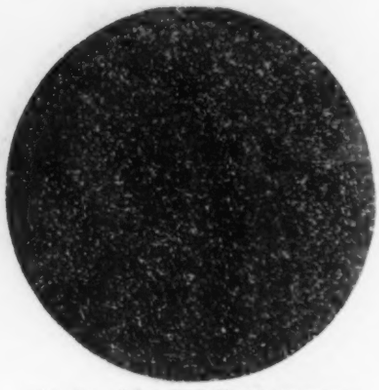

Fig. 24—Quenched From 1420 Deg. Fahr.

wood-burning furnace with little care being taken to protect the material from excessive oxidation.

It has been found that the most uniform results in annealing have been obtained in those shops using boxes or other suitable containers, which had been carefully sealed, and in which charcoal or other carbonaceous material had been used to pack around the blanks in the box. Even with these precautions slight decarburization may occur as shown in photomicrograph, Fig. 19, showing a section taken from a blank which had been carefully ground before having been annealed. This small amount is, however, not a serious matter.

The fact that file steel blanks have been packed in boxes and carefully sealed, and a pyrometer has been employed to indicate the temperature of the furnace used, is not a criterion that the steel will be properly annealed as is shown in photomicrographs, Figs. 20 and 21. These were taken from two separate pieces of steel, taken from different boxes which had been in the same furnace at the same time. The furnace employed was a side-fired oil-burning type. The sample from which the photomicrograph was made was taken from a box which rested on the floor of the furnace. The other sample was in a box that protruded several inches above the bridge-wall of the furnace where it had been exposed to a very hot flame. The pyrometer used showed that a temperature of 1440 deg., Fahr. had been used. However, the method of packing the furnace and the position of the thermocouple in the furnace with relation to the charge, as shown in Fig. 30, discloses the reason for the lack of uniformity. The shaded areas in the drawing show the approximate position of cold areas.

To secure the best results in annealing, care should be used in charging the furnace so that the boxes or bundles do not rest directly on the floor and a slight distance away from the door. They should be raised at least 2 in. from the floor regardless of whether the furnace is under-fired, over-fired or side-fired. By raising the charge the circulation of hot gases is expedited and the causes for cold spots lessened. If boxes are piled one on top of the other, they too should be separated about 2 in., and attention should be paid to the position of the top boxes so that they do not protrude above the bridge-wall in side-fired furnaces, or too near the arch in any furnace. The thermocouples should be so placed so as to indicate the temperature of the furnace at points nearest the charge rather than the temperature of the hot gases in the roof or arch of the furnace. Care should be taken so that at no time the indicated temperature exceed that desired for annealing, a condition very often resorted to to hasten the operation.

The best structure for file steel that has been annealed is one in which all of the cementite has been spheroidized. Such a structure is shown in photomicrograph, Fig. 22. It is possible to produce this condition by annealing at 1440 to 1460 deg. Fahr., followed by slow-cooling to at least 800 deg. Fahr. in the furnace.

Improper grinding of the annealed blanks can also cause trouble for the manufacturer. An excellent plan to determine whether the grinding has been uniform or whether the steel has been more deeply decarburized on one side than on the other is to take several representative blanks from each annealing and grind as usual. Then harden, and fracture each piece several times, noting the structure at each fracture. Any decarburization is easily seen and proper precautions for working the steel may be taken.

Soft spots from excessive decarburization, carbon segregation, etc., are easily detected in the cutting of the files, especially where the modern cutting machines are in use. The cuts produced in the soft places are deeper and broader than in the rest of the file.

The hardening of files is generally carried on by coating them with a suitable paste, usually made from some carbonaceous material, the fohmula for which is different in most every shop, and heating to the desired temperature in a lead pot, followed by quenching in a salt bath. The paste acts chiefly as a protection against lead adhering to the teeth of the file. It is easily knocked off the file after it is taken from the lead pot and before being plunged into the quenching bath.

The chief causes for failure in the hardening of files, provided they have been made from good material, and proper care has been exercised in previous processes, is overheating. The effects of various tempera-

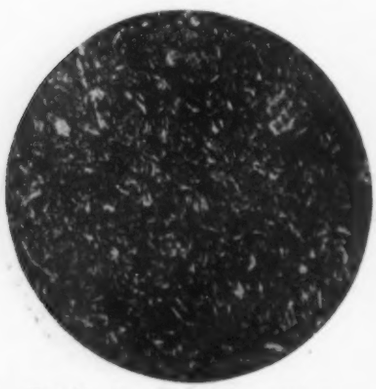

Fig. 25—Quenched From 1600 Deg. Fahr.

Fig 26—Quenched From 1700 Deg. Fahr.

Fig. 27—Quenched From 1800 Deg. Fahr.

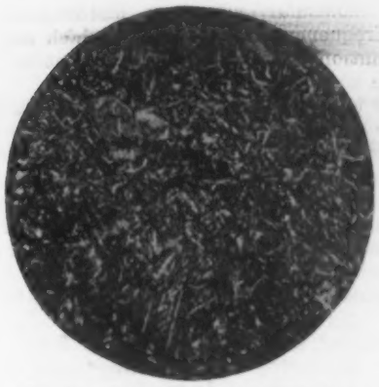

Fig. 28—Quenched From 1900 Deg. Fahr.

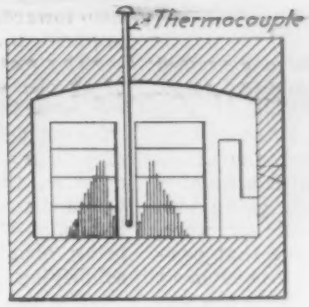

Fig. 30

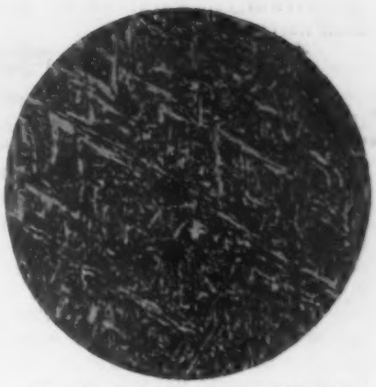

Fig. 29—Quenched From 2100 Deg. Fahr.

tures for hardening file steels may be judged by referring to photomicrographs, Figs. 23, 24, 25, 26, 27, 28 and 29, the best structure being produced in the steel when quenched from 1420 deg. Fahr. When file steels are quenched from too high a temperature, the teeth become very brittle and are easily knocked off, or else the files break in quenching.

It has been shown by text and illustration what some of the more common causes for file steel failure are. The suggested means for their correction are by no means arbitrary. Care in making the steel, care in rolling the steel, which includes the heating for rolling, and care especially in forging and annealing the steel has been shown to eliminate most of the troubles. The attention directed to the production of spheroidized cementitic structure in the annealed files will generally assure blanks being produced that can be cut easily and harden splendidly.

Ingot Structure and Heat Treatment

Importance of Controlling the Former as an Aid to the Latter—Possible Effect of Electro-Magnetic Treatment During Solidification

BY B. D. SAKLATWALLA*

THE most remarkable property of steel, increasing its technical usefulness and differentiating it from other alloys, is its wonderful susceptibility of structural changes below its solidifying temperature, in other words its amenability to heat-treatment. The purpose of this treatment is to bring about physical conditions superior to those existing in the original solidified condition. We may, therefore, consider the heat-treating process as a continuation of the changes starting from liquid steel and going through the intermediate state at the point of solidification. If we assume this continuity, we find that through development in the art of heat-treatment we have been able to wonderfully control the changes occurring in the period after solidification, but that we have scarcely made any efforts to control the structural changes occurring prior to or during solidification, which changes undoubtedly are of primary importance and their effect persists through the later stage after solidification.

Factors at Play During Melting and Cooling

Liquid steel prepared in the furnace can probably be finished in a more or less perfect condition. From this desirable condition, during the subsequent operations of tapping, pouring, etc., it is unfortunately subjected to deteriorating influences. When the molten metal is tapped the stream comes in contact with the atmospheric gases which can be absorbed physically and chemically, and also the molten metal is stirred up with non-metallic material, such as ladle lining, slag, etc. Consequently, the liquid steel as poured in the molds is always more or less subject to the evil influences of non-metallic inclosures, dissolved oxides, nitrides, blow holes, shrinkage cavities, etc. These innate deficiencies in the ingot are not going to be offset by any later heat-treatment processes in the solid state. It is therefore important to study and if possible control the changes taking place during solidification in the mold.

For the purpose of improving mold setting conditions several expedients are resorted to, such as different ways of casting, either bottom or top pour, changing design and size of molds, keeping the top hot, applying increased or decreased pressure during solidification, and resorting to chemical agents such as aluminum to remove gases. All these practical expedients aim, however, at removing the mechanical apparent defects and impurities without trying to influence the primary crystallization and molecular structure of the ingot.

The physical forces at play during the process of cooling of a body from the gaseous to the liquid and the solid state have been more recently investigated from the modern standpoint of atomic structure. If, for instance, we follow the cooling process of a gas, through the liquid, to the solid state we can picture the following phenomena: The atoms forming the gas, taking it to be monatomic for the sake of simplicity, are, according to the kinetic theory, in a state of constant motion depending on the temperature. Within the confines of the gas volume, these atoms would meet other atoms in similar motion. In the case of such an impact the atoms would rebound from one another. These atoms would be under the influence of two forces, the one a cohesive force between the atoms and the other the force of rebound. In the gaseous state the latter force is by far more the preponderating. As the temperature of the gas and consequently the kinetic energy of the atoms is diminished, the rebound force becomes less, the cohesive force comes more into play, and the body assumes a liquid form. On still further decrease of temperature the cohesive force becomes the more preponderating, the rebound force is absent and the body solidifies. If under the influence of the cohesive forces the atoms on solidification arrange themselves into definite

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geometrical configurations we have crystalline bodies such as the metals.

Cohesive Force and Solidification

In this solidification procedure we have described the attractive force between atoms as a cohesive force. The idea seems to be fairly well established that this cohesive force is of an electro-magnetic nature. According to the modern concept, the atoms consist of a positively charged nucleus with a number of negatively charged electrons. Without going into a discussion of the various theories of atomic structure, it might be said that it is easy to conceive that positive and negative charges, under certain arrangement in the atom and with certain relations of these charges to those of other atoms, can bring about forces of an electro-magnetic nature. If, therefore, the aggregate condition of matter is dependent on these bonds of cohesion, electro-magnetic in nature, the presence of other electro-magnetic forces, extraneously applied, will undoubtedly influence the physical properties depending on these atomic bonds. Hence we can see the possibility of controlling the bonds of cohesion on which crystallization of metals depends by extraneous means.

Electro-Magnetic Force and Crystal Growth

If a liquid metal is subjected to the influence of an electric or magnetic field, its different constituents will be differently affected depending on their characteristics of conductivity, permeability, etc. Also the setting up of an alternating electric current through the molten steel may cause molecular vibratory disturbances, depending on the frequency of the current, which may help towards elimination of occluded gases, non-metallic impurities, and the like.

The most novel effect, however, from the presence of an electric or magnetic field can be expected from the influence exerted on the electro-magnetic bonds of cohesion determining crystal growth. Hence the rate of primary crystallization, the distribution of primary crystals, the grain size, etc., would be affected. It would therefore probably be feasible, by controlling the intensity of the extraneous electro-magnetic field, to bring about refinement of crystal structure in the solidifying ingot.

The practical means of producing such a field in which a steel ingot or casting could solidify would be a comparatively simple matter. It would be possible to pass a current, direct or alternating, of low or high frequency, through the body of the solidifying ingot, or such currents could be induced in the contents of the mold by extraneous conductors. Each method of procedure will undoubtedly show different results.

The application of the electric current in the production and refinement of steel has shown within the last decade very far-reaching results. Let us hope that the application of electrical energy towards the refinement of ingot structure may show equally remarkable results in the future and partly accomplish the result achieved today by heat treatment of the finished material, thus helping to alleviate in some measure some of the present trials and tribulations of the heat treater.

Steel Structural Parts for Aircraft

Control in Their Heat Treatment—Alloy Steels Which Have Been Adopted—Use of Metal in Aircraft Increasing

BY HORACE C. KNERR*

ABSOLUTE dependability combined with minimum weight is the difficult ideal to be attained in the construction of aircraft, perhaps more than in any other industry. Materials must be selected for their uniformity and reliability as well as for superior physical properties. Processes and inspection must be such as to insure that each individual part fully meets its designated requirements. A single defective member in an airplane, consisting of many thousands of different parts, most of which are highly stressed, may cause disaster. In the classic words of one dusky philosopher—"when a' automobile breaks down, dar you is, but when a' ary-plane breaks down, *whar* is you?" The most rigorous inspection of raw material and fabricated parts is therefore essential.

Economy Through Standardization and Technical Supervision

Simplification of practice, standardization of processes and material, careful workmanship, rigid inspection and close technical control and supervision, have resulted in reducing rejections of structural parts after heat treatment at the Naval Aircraft Factory from an originally high figure to an almost negligible quantity. Besides contributing to the safety essential to aircraft work and eliminating the delays incident to replacing unsatisfactory material, this has afforded substantial economies in production, which more than compensate for the cost involved.

During the year of 1922 a total of over 88,000 structural parts of aircraft were heat-treated at the Naval Aircraft Factory with only a single rejection, this one being for incorrect material. All heat-treated parts are subjected to a close inspection for cracks, warping, scale, etc., and are required to come within specified hardness limits. Most of the parts treated are not of a difficult nature, and production is on a moderate scale, but it is believed that the results clearly demonstrate the value of the methods employed, and that these methods are applicable to other industries engaged in the manufacture of high grade metal products.

Use of Metal in Aircraft Increasing

There is little doubt that aircraft of the future will be of all-metal construction. The hazards of fire, decay, deterioration by the absorption of moisture, limitations and uncertainty of supply, and other drawbacks connected with the use of wood are too serious to permit survival for long. The growing tendency toward the increased use of metal in aircraft is retarded by the difficulty of obtaining suitable high grade structural metals of dependable quality on the market, especially sheet and seamless tubing. Duralumin and other light alloys are formidable rivals of steel in this field and are making rapid strides, but the growth of the aircraft industry is destined to offer an ever-widening market for ferrous as well as non-ferrous alloys of superior quality.

At present, the majority of airplanes and flying boats have their larger structural members made of wood. But even in these there is a very important class of parts, subject to high stresses, such as bolts, eyebolts, wing hinges, wire terminals, braces, struts and strut ends, engine mountings, landing gear braces, axles, and miscellaneous parts of more or less compli-

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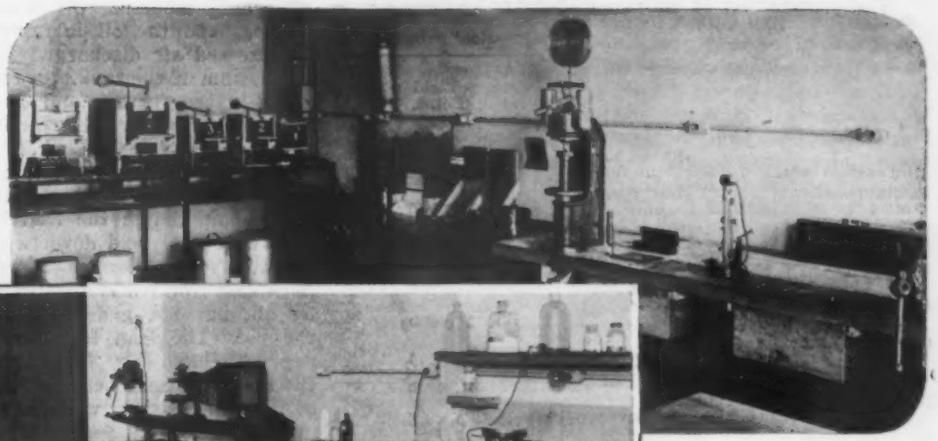


The Office (Below) and Part of the Microscopic Equipment of the Metallurgical Laboratory

Some of the Heat-Treating and Other Testing Apparatus of the Metallurgical Laboratory of the Naval Aircraft Factory

cated design known as "fittings," which are made of steel and which must be thoroughly dependable.

Chemical and Physical Requirements Specified

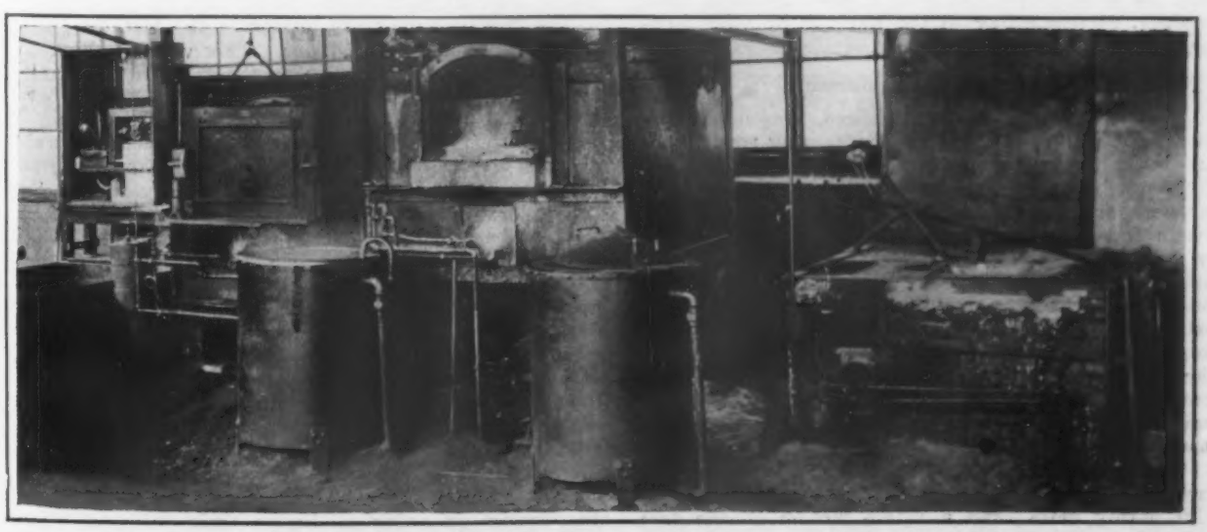
All steel is purchased under detailed specifications, covering both chemical composition and physical properties. Formerly, physical properties were the determining factor, the contractor being permitted to furnish any one of a number of different steels which, when suitably heat-treated, would have the specified tensile strength, yield point, elongation, reduction of area, etc. For example, a certain specification called for alloy steel bar stock having the following physical properties after heat treatment as recommended by the manufacturer:

Tensile strength (min.), lb. per sq. in.....	125,000
Yield point (min.), lb. per sq. in.....	95,000
Elongation (min.) in 2 in., per cent.....	17.0
Reduction of area (min.), per cent.....	50.0

This specification permitted the use of any one of 18 steels of different composition, including five nickel steels, 12 chrome-nickel steels and one chrome-vanadium steel. Such a wide choice of compositions under a given specification was permitted on the supposition that since physical properties were the ultimate aim, any steel which would meet physical tests would be satisfactory.

However, a different heat treatment would be required for nearly every one of the different steels mentioned to give it the desired properties. As heat treatment is done after fabrication it would be necessary to identify each different composition through stores and production, in order to apply the correct heat treatment. This would result in great complication of records, marking and storage, and numerous mistakes would be almost inevitable.

In order to simplify design, inspection, stockkeeping, manufacture and repair, a minimum number of steels have been adopted as standard at the Naval Aircraft Factory for use in structural parts, and physical requirements reduced to the least variety which will meet the needs of design. One standard S. A. E. steel under each set of physical requirements has been selected, the choice being based upon its availability on the market, its working qualities and the readiness with which it would meet the specified physical properties. This simplification has brought the total number of steels used for structural parts down to six, and a still further reduction may ultimately be accomplished.



Heat-Treating Equipment in the Naval Aircraft Factory, Philadelphia

The present list of standard steels is as follows:

Grade	Steel No.	Form	Physical Properties: Tensile Strength, Lb. per Sq. In.	Yield Point, Lb. per Sq. In.	Elong. in 2 In., Per Cent
Mild carbon steel	1025	Sheet, bar and tubing	55,000	36,000	22
Medium carbon steel	1035	Bar, forgings only	80,000	60,000	22
High carbon steel [a]	1095	Sheet, rod and wire	.....	.....	..
Nickel steel, 3.50 per cent	2330	Bar and seamless tubing	125,000	95,000	17
Chrome-vanadium steel	6130	Sheet	125,000	100,000	10
Chrome-nickel steel [b]	3135	Bar	150,000	115,000	14

[a] Steel No. 1095 is used only to a small extent, chiefly for light springs.
[b] Steel No. 3135 is used moderately for parts subject to specially high stresses and wear.

Chrome-vanadium steel was adopted as standard for sheet after a careful comparison of three leading types of alloy sheet steel—3.50 per cent nickel, No. 2330; chrome-nickel, No. 3130, and chrome-vanadium, No. 6130. The latter was found to have distinctly the best properties in cold bending. ("Three Types of Alloy Sheet Steel" H. C. Knerr, THE IRON AGE, Sept. 8, 15 and 22, 1921.) Unfortunately this steel is not available in the form of seamless tubing in the sizes and gages required. It has therefore been necessary to include two steels, Nos. 230 and 6130 under the 125,000-lb. class.

Steels are indicated on drawings and material requisitions by their S. A. E. steel number, the N. A. F. heat treatment symbol being appended thereto on drawings.

Inspection Tests of Raw Material

All stock intended for structural parts is first given a thorough inspection for dimensions, surface condition and mechanical defects. Test coupons are then taken, tensile specimens being heat-treated before testing. Bend tests are also made on sheet, and crush tests are applied to tubing, in the condition in which furnished by the manufacturers (annealed). These latter tests are for the purpose of detecting defects in the material, and to insure that it has been properly annealed for working. They have been found very effective. Sheet steel is required to withstand bending cold through 180 deg., the worst way of the grain, over a diameter equal to its own thickness, without cracking. The crush test for tubing consists in crushing endwise a section whose length is 1½ times the diameter of the tube until one complete fold is formed, or its outside diameter is increased 25 per cent in one zone, or its length is reduced to one diameter, without cracking. The same tests are applied to both alloy and mild carbon steel sheet and tube.

Chemical analysis is made from samples representing the full thickness of the material. Upon acceptance, all steel is painted with a distinguishing color (stripe), corresponding to the analysis or steel number, before being placed in stock.

Heat Treating Equipment

Heat treatment is done in oil-fired, semi-muffle furnaces, a lead pot being used for tempering small parts such as bolts, eye-bolts, forgings, clevis pins, etc.

Before being put in service, and from time to time, furnaces are checked for uniformity of temperature within the hearth. The temperature is held constant by means of the furnace couple located at the center, and the hearth is explored for hot or cold spots by means of one or more auxiliary couples placed at various points. The temperature within the hearth is required to be uniform within plus or minus 5 deg. C. The furnaces are underfired, so that the charge is heated from all directions. A slightly reducing atmosphere is maintained, judged by the vent flame. Flames do not come in contact with the charge.

Quenching tanks are located close under the furnace door, so that parts may be withdrawn and quenched with hardly more than a single motion of the arm and no loss of time. Oil is used almost exclusively as a quenching medium. Oil tanks are water-jacketed for cooling, and the oil is rapidly agitated by means of compressed air discharged from a perforated pipe at the bottom of the tank. Small parts are placed in metal trays in the furnace and dumped into the oil with a spreading motion. They are caught in a wire basket suspended in the oil tank.

Large parts are tempered in the furnace. Small parts are dusted with powdered charcoal while oily, and submerged in the lead tempering bath by means of a wire grid held down with a lever. The charcoal effectually prevents sticking of lead to the work.

A cast iron pot is used to contain the lead. Firing is by oil, but hot gases making a complete circuit of the pot. The lead is never heated above about 600 deg. C. (1100 deg. F.). The same pot, furnace and thermocouple have been in use for more than four years at date of writing, without replacement, and are still in good condition.

Temperature Regulation

Temperatures are regulated by means of a Leeds & Northrup multiple-point recording pyrometer, mounted in a cabinet near the furnaces, so as to be protected, but readily accessible to the heat treater. The continuous record is of great assistance to the operator in regulating temperatures, and the fact that it is available for inspection has an excellent influence in preventing carelessness. Connections are provided in the cabinet for substituting a portable indicating pyrometer for the recorder without delay should the latter get out of order.

Automatic control has not been attempted because of the variety of temperatures at which furnaces and lead pot are required to operate. Manual control has been found quite satisfactory. Temperatures can be adjusted and held constant within plus or minus 5 deg. C. without difficulty.

Iron-constantan thermocouples are used. The furnace couples are sheathed with 1¼-in. black iron pipe with a plug welded into the end (galvanized pipe cannot be used as the zinc attacks the couple). The head of the couple is inclosed in a larger piece of pipe so that the connections between couple wires and lead wires are at uniform temperature, avoiding parasite electromotive forces which would be set up were the brass connections hotter at one end than the other. Duplex iron-constantan lead wires are run without joints from the head of the couple to the pyrometer terminals through metal conduits. The pyrometers have automatic cold junction compensators. The couples extend into the center of the hearth a distance of about 2 ft., so that there is no danger of error by conduction of heat along the couple. The couple in the lead pot can be immersed to a depth of only about 8 in., and is therefore provided with a light sheath made of 1-in. seamless steel tubing, about 1/16 in. thick, to avoid conduction errors. (The present sheath has been in service more than 4 yr.).

Calibration of Thermocouples

The thermocouples are welded in the metallurgical laboratory from certified wire. This wire is checked for accuracy and uniformity by the manufacturer and runs very true but, as an additional precaution, every new lot of wire is checked against a standard platinum-platinum-rhodium thermocouple in the metallurgical laboratory. Three noble metal couples are kept as primary standards, having been calibrated by the U. S. Bureau of Standards. Only one of them is used for checking base metal couples, the other two being used at intervals to check that one, thereby insuring the detection of any variation.

Checking is done in an electric muffle furnace, which, after heating up on the shop power line, is held at the required temperature on a separate storage battery circuit to avoid temperature fluctuations due to variations in line voltage. Preliminary readings are taken until all the couples show constant readings for a reasonable time, before taking the final readings. The hot junctions are bound together and inserted in a heavy cylinder of cast iron placed in the center of the furnace in order to insure their being at the same temperature. This cylinder is about 8 in. long,

3¼ in. in diameter, with a center hole 1¾ in. in diameter and 7 in. deep. Couples are checked at at least three different temperatures. The noble metal couple has a sheath to prevent contamination; the base metal couples are bare.

An iron-constantan couple checked in this way against the noble metal standard is used as a secondary standard for checking the couples in the shop. This secondary standard is encased in a sheath made of a piece of 1-in. diameter seamless steel tubing of 1/16 in. wall thickness, the end being closed by welding. It is inserted directly alongside the couple to be checked in the furnace. Readings are taken on an indicating pyrometer of the potentiometer type, and must agree with the readings of the recording prometer to which the furnace couple is connected, within plus or minus 5 deg. C. This constitutes a check of the whole temperature measuring system. The furnace is held at constant temperature, and simultaneous readings of the standard couple and furnace couple are taken until both have remained constant for about ten minutes, before the final reading.

All factory couples are checked in this way by a representative of the metallurgical laboratory at intervals of from one to eight weeks, according to the severity of their service. Check readings are reported to the metallurgist on the form shown below:

Calibration of Thermocouples

Location..... Date.....

Standard Couple No..... Furnace Couple No.....

Time of Day	Standard Couple, Degrees	Furnace Couple, Degrees	Correction, Degrees	Remarks
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....
.....	.....	.....	.....	.....

Approved ..... Data by.....
Metallurgist.

When a furnace couple is in error more than 5 deg. C., it is removed. Every couple is given a serial number when made, and its service recorded.

Technical Supervision of Shop Processes

All heat-treating processes are under the technical supervision of the metallurgical division of the engineering department. The metallurgist keeps in close, personal touch with these operations in the factory. Under the chief engineer, the metallurgist prepares specifications for the purchase of metals and their heat treatment. In consultation with the mechanical superintendent of the works department, he assists in the preparation of plans and specifications for heat-treating equipment. All pyrometric equipment is under the direct care and supervision of the metallurgical laboratory.

Heat-treatment specifications cover the process in considerable detail, as is illustrated by the following specification for chrome-vanadium steel. It will be noted that the quenching temperature is held within comparatively close limits.

Heat Treatment Specification for Chrome-Vanadium Sheet Steel No. 6130

1. When the work is inserted, the temperature of the furnace shall not exceed 650 deg. C. (1200 deg. Fahr.). Raise the temperature gradually to between 870 and 885 deg. C. (1600 to 1625 deg. Fahr.). Hold this temperature for 20 min.
2. Remove the parts from the furnace and instantly quench in oil with vigorous agitation, until cold.
3. After quenching, the Brinell hardness should be from 300 to 475, according to the thickness of the sheet, thin sheets being the harder.
4. Insert the work in a furnace or lead pot whose temperature is not above that to be used in tempering, and hold for at least 20 min. at the temperature indicated by the Brinell hardness after quenching, as follows:

Brinell Hardness After Quenching	Tempering Temperature
300 to 350	425 deg. C. (800 deg. Fahr.)
350 to 400	455 deg. C. (850 deg. Fahr.)
400 to 475	485 deg. C. (900 deg. Fahr.)

5. Remove the parts and allow them to cool in still air.
6. A Brinell hardness of from 250 to 325 should result.
7. Physical properties required:
   Ultimate tensile strength..125,000 lb. per sq. in.
   Elongation in 2 in.....10 per cent

After quenching, Brinell hardness tests are made on a number of samples from the batch by the metal shop inspector. He reports the hardness to the heat treater, who uses the corresponding tempering temperature. After tempering, a large proportion, or all, of the parts are tested for hardness by the metal shop inspector, and are required to come within the specified hardness limits. These hardness limits are such as to insure the required tensile strength and ductility, and are determined by experiment on test coupons of the material.

Variations in chemical composition of the material even within the approved S. A. L. tolerances (plus or minus 0.05 per cent carbon, 0.15 per cent manganese, 0.25 per cent nickel, etc.) cause considerable variations in the hardness after heat treatment. Any parts failing to come within the specified hardness limits are returned for re-treatment, when the temperatures may be slightly modified. If they again fail, they are rejected. Cracks, deformation or excessive scale are also cause for rejection.

Rejections after heat treatment are immediately reported to the metallurgist by the metal shop inspector on the form below:

Date.....

To: Metallurgist

The following material has failed to pass inspection after heat treatment:

Name or Description.....
Part No.....
Job No.....
Quantity Rejected.....
Quantity Passed.....
Steel Specification No.....
Heat Treatment Specf.....
Hardness, Quenched.....
Hardness, Drawn.....
Hardness Required Quenched.....
Hardness Required Drawn.....
Remarks .....
.....
.....

(Signed) .....
Inspector, Metal Shop.

Recommendations .....
.....
.....

Date.....

.....
Metallurgist.

A prompt investigation is made and the cause of failure determined. Steps are taken, if possible, to prevent recurrence of the failure. This practice has been one of the principal factors in reducing rejections to a minimum. It prevents blame being placed on the heat treater for failures which are due to causes beyond his control, and on the other hand makes it possible to correct any error which he may be committing, before the matter has gone very far. The metal shop inspector keeps a record of all parts heat-treated, stating the part or drawing number, the quantity of parts in each lot, the maximum and minimum hardness, and the number and cause of rejections, if any. In this way it is possible to compare the efficiency of the work for any periods desired.

The work of inspection is under the engineering department, which is concerned primarily with quality of output. The inspection of heat-treated parts has been exceedingly careful and conscientious and no parts are allowed to pass which are not fully up to requirements.

A summary of the heat-treating record for the past five years taken from the log of the metal shop inspector is given below. The period from August to December, 1918, when rejections reached nearly 9 per cent, was before the present system of supervision was put into operation. The subsequent annual periods show a substantial and progressive decrease. These results appear to be adequate proof of the economical value of accurate control, and close technical supervision of heat-treating processes.

RECAPITULATION

Heat Treatment Log, Naval Aircraft Factory
Structural Parts

Period	Total Parts Treated	Parts Rejected After Heat Treatment	Per Cent Rejection
August to December, 1918, inclusive	75,431	6,669	8.85
Year of 1919	72,287	173	0.24
1920	103,921	44	0.042
1921	249,376	35	0.014
1922	88,312	1	0.0011

Summary

Rejections of heat-treated structural parts, even when subject to rigid inspection and close hardness

limits after treatment, may be reduced to a comparatively negligible quantity by proper precautions, including the following:

1. Purchase of steel under suitable specifications, including chemical analysis and physical properties.
2. Restriction of each grade of steel to a standard S.A.E. steel number, or within similar or closer chemical tolerance limits.
3. Inspection and test of raw material to insure that specifications are met.
4. Standardization upon a minimum variety of steels and treatments.
5. Accurate specifications for the heat treatment of each grade of steel.
6. Correctly identified stock.
7. Reliable pyrometers, frequently checked.
8. Properly designed and operated furnaces, quench tanks, etc.
9. Hardness tests of parts, after quenching, to designate correct tempering temperature, as indicated by heat treatment specification.
10. Intelligence, care and conscientious attention to instructions on the part of the heat treater. (Technical knowledge not necessary.)
11. Active technical supervision of heat-treating operations, by an experienced metallurgist, and immediate investigation of all failures to determine their cause and prevent their recurrence.

X-Rays in the Steel Industry

Origin and Properties—Hidden Defects and How to Find Them—Some of the Work Already Done

BY DR. ANCEL ST. JOHN*

WHAT use are X-rays in the steel industry? Ten years ago the answer would have been, "No use at all!" Today, however, owing to the activities of several earnest investigators in this country and abroad the answer is vastly different. X-rays are being used to find the extent and nature of hidden defects in castings and forgings and to go beyond the realm of the metallurgical microscope in studying the reasons for the special properties of treated steels.

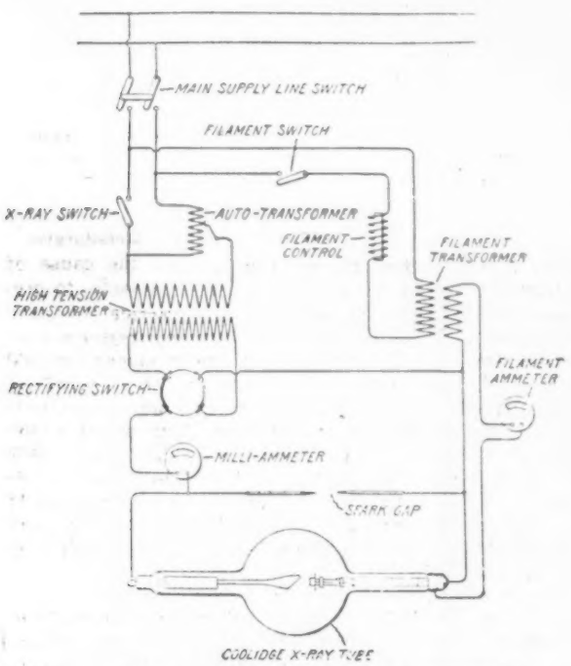


Fig. 1—Diagram of X-Ray Apparatus

It is, therefore, pertinent to call attention to a few outstanding features of the work already done and to indicate some of the more important articles describing the methods used. The examples and references given by no means represent all the work that has been done; they are instances of noteworthy achievements selected to arouse the interest of steel makers, steel treaters and steel users in the possibilities of X-rays in the steel industry.

Origin and Properties of X-Rays

It is well at this time to recall certain facts concerning X-rays and their behavior. X-rays arise when rapidly moving electrons are abruptly stopped by matter. The general mechanism of their production is the same as for the production of visible light and the X-rays themselves differ from light waves only in having much shorter wave-lengths, less than one ten-thousandth those of light. According to accepted theory an atom consists of a positively charged center or nucleus surrounded by a number of negatively charged particles or electrons, the whole forming a sort of miniature solar system. The mass and charge of the nucleus and the number of surrounding electrons are characteristic of each element and are nearly proportional to the atomic weight, but the electrons themselves are the same for all elements.

Ordinary light is produced when agitation of the atoms, due to combustion, excessive heating by an electric current, or some other cause displaces the electrons forming the center portion of the atom from their normal positions or paths. X-rays are produced only when the inner electrons are displaced. This is accomplished by the impact of a free electron moving with sufficient speed to penetrate to the interior of the atom. In either case the displaced electrons vibrate with definite frequencies, depending upon the structure of the atom and the original position of the electron, until they dissipate the energy acquired during the displacement as radiation of wave-lengths corresponding to the frequencies. The X-rays given off in this manner thus have wave-lengths peculiar to the atom and are called the characteristic X-rays of that element. In addition the stoppage of the free electrons sets up a series of waves, known as the general or independent X-rays, of wave-lengths exceeding a minimum determined by the speed of the electron.

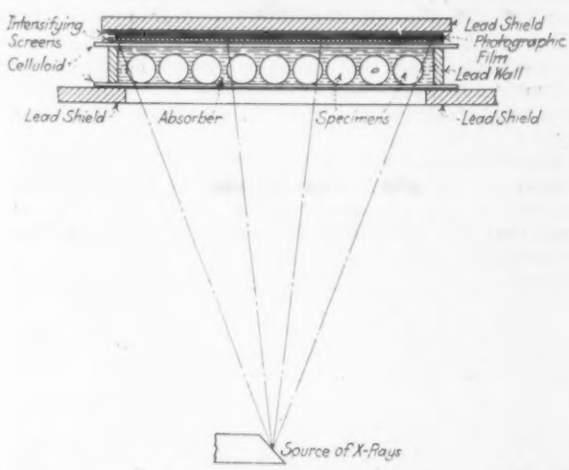


Fig. 2—Diagram of Radiographic Set-up

The necessary speed is imparted to the free electrons by impressing a suitable voltage between electrodes in a vacuum. Since the electrons in the interior of atoms of high atomic weight vibrate more rapidly and so give off shorter waves than those in atoms of lower atomic weight, since a greater speed is required for a free electron to penetrate to the

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interior of such an atom, and since finally, the speed of the free electron increases with the impressed voltage, the voltage necessary to produce X-rays of a given wave-length is inversely proportional to the wave-length, and the voltage required to produce the characteristic X-rays of an element increases rapidly with the atomic weight. Thus three volts suffice for hydrogen X-rays, whereas about 20,000 volts are required for molybdenum and about 90,000 volts for tungsten. A typical apparatus for generating X-rays is shown diagrammatically in Fig. 1. The supply of free electrons is produced by heating a tungsten filament to incandescence. The voltage is applied between the filament and a block of metal, usually tungsten, often called the target. The X-rays arise when the electrons hit the target.

When X-rays fall upon a substance, part of the energy is absorbed, part scattered without change of wave length and the balance passes through. Much

Fig. 3—Lester: 400-lb. Casting Ready to be Radiographed

of the absorbed energy is reradiated as longer waves, known as secondary X-rays, characteristic of the absorbing substance, but in some cases a part may cause chemical and physical transformations, such as ionizing a gas, activating a photographic emulsion, or causing a fluorescent glow, which may be used to detect and record the presence of the rays. The amount of this absorption and scattering depends on the wave-length of the rays, the number and arrangement of the electrons in the absorbing atoms and the number of atoms traversed. Expressed in another way, it depends somewhat upon the atomic weight of the target but principally upon the voltage across the tube and the atomic weight, density and thickness of the absorber. For a given voltage the absorption increases rapidly with the atomic weight of the absorber, for a given absorber it decreases rapidly as the voltage increases.

X-rays are only slightly visible to the human eye and produce such serious physiological consequences, when they fall on any part of the body frequently or for a long time, that other means, such as those already mentioned, must be used for observing them.

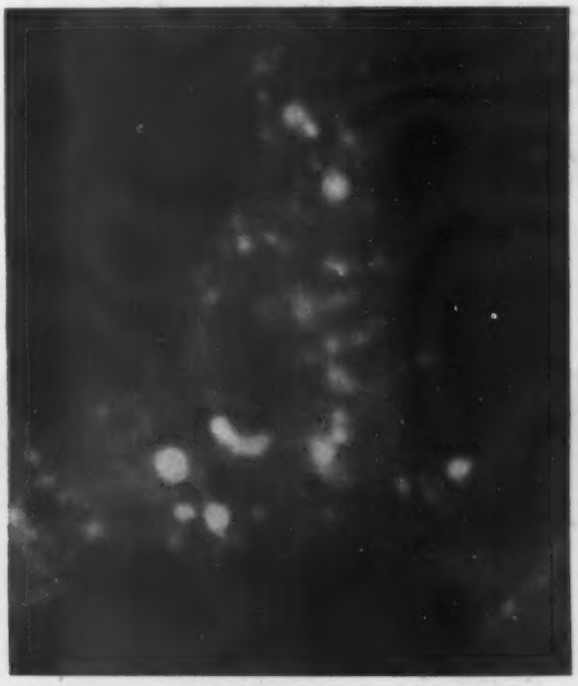


Fig. 4—Radiograph through Head of Casting

For general purposes the photographic effect is the most convenient.

Finding Hidden Defects in Steel

The method used for finding hidden defects in steel with the X-rays is similar to that used by the surgeon in examining the human body, except that since the materials examined are much less transparent to the rays a much greater penetrating power is required. The general arrangement of the apparatus is shown in Fig. 2. The object to be examined is interposed between the X-ray tube and a photographic film and exposed for the proper length of time to

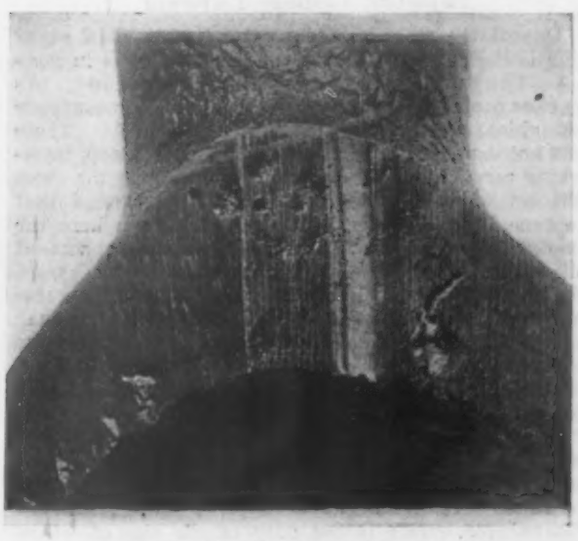


Fig. 5—Section through Head of Casting

X-rays of the appropriate character. In the resulting shadow picture cavities, thin spots and foreign matter of atomic weight lower than the material as a whole are recorded as regions of increased illumination, while foreign matter of higher atomic weight appears as a region of decreased illumination.

A great deal of valuable information concerning X-ray examination of steel castings has been given by Dr. Lester of the Watertown Arsenal.[1] Dr. Lester

shows that more than 3 in. of steel can be radiographed satisfactorily in a 30-minute exposure at 195,000 volts with commercial equipment at present available. Cavities as small as 2 per cent of the thickness of the part examined can be detected with certainty. Some idea of the objects examined can be gained from the accompanying Figs. 3, 4 and 5 taken from Dr. Lester's article. Fig. 3 shows a 400-lb. casting for an air bomb, ready to be radiographed. The risers have not yet been removed. Fig. 4 is a radiograph with the rays passing along the vertical axis of the casting where they traverse slightly more than two inches of metal. The dark shadows are the risers and the mottled regions show that the risers were not feeding properly. Fig. 5 is a section through the defective head showing some of the holes responsible for the spots in Fig. 4. On the information furnished by the radiograph the design of the risers was changed and the difficulty remedied. The article contains data on the correct voltages and exposures for various thicknesses of steel, notes on the proper positioning of tube, casting and film, suggestions on the interpretation of results and contributions to the theory of radiography.

(To be concluded)

Steel Castings for Sugar Mills

Developing an Alloy Steel to Withstand High Pressure—Its Manufacture, Heat Treatment and Properties

BY HARRY J. BARTON*

ONE of the largest and most important industries of today is that of sugar making, yet it is one line of endeavor with which very few foundries come into contact. With a great proportion of the world's sugar coming from Cuba, Porto Rico, and Louisiana it is natural that southern foundries should specialize on this class of work. During the past few years the competition in sugar mill castings has become very keen, and practically all machinery is sold on a guarantee. Each shop is striving to make superior products, and a great deal of experimentation is being done along the lines of new metals, heat treatment, etc.

Important Castings Employed

One of the most important castings used in sugar mills is the cap which holds the crushing rolls in position. The duty of this cap is about as follows: As the cane comes from the fields it is placed on a conveyor belt which carries it to the first set of rolls. These rolls are usually of steel, and are cast with deep, interlocking corrugations in order to properly grip the cane. This set of rolls is two-high, and so arranged that the cane is well pulped on this pass. From here the crushed mass travels through several other sets of rolls each with a smaller clearance as the train progresses. Frequently hot water is sprayed on this pulp to increase the yield of juice, which tends to swell the mass making the rolling more difficult. Often, due to carelessness on the part of a laborer, a fork, or crowbar falls into the moving cane, further increasing the strain on the rolls.

Naturally there must be some sort of an arrangement to compensate for slight movements in the rolls, keeping them at the desired clearance but allowing for an upward movement when some foreign element is introduced. This is the duty of the cap of which there are two kinds. There is the "top cap" which holds the upper roll in position, and the "side caps" which work on the two lower rolls, the three rolls being on an equilateral triangle, base down. The upper roll is the one which does all of the heavy crushing and consequently it is the "top cap" upon which the brunt of the heavy duty falls. The roll shaft fits into a heavy side frame casting which is slotted to receive the shaft bearing. This bearing is made in two parts, the lower, which is stationary, and the upper, which is movable. Upon this upper bearing is placed a heavy, close fitting steel plate casting, slightly recessed on the top side. Into this recess fits a short piston rod the upper end fitting into the top cap. The upper end of the top cap is connected to a hydraulic arrangement, set at whatever pressure is desired.

*Diebert, Bancroft & Ross Co., New Orleans, La.

High Manganese Steel Adopted

We will assume a batch of cane going through the rolls. The hydraulic cylinders are set at 6000 lb., keeping the roll clearance at ½ inch. Due to some irregularity the cane clogs and is bunched under one set of rolls. Immediately the pressure rises above the safety mark, the roll is forced up, the piston rising in the top cap and allowing the needed upward movement. As soon as the lump passes the hydraulic pressure forces the piston down, and the roll drops to its customary position.

It becomes clear why the cap is a very important part of the mill, and why such care must be used in its manufacture. To briefly summarize what must be obtained for a high grade cap:

1. The metal must have a maximum toughness to withstand the constant strain, both from the pressure, and the constant vibration of the crushers.
2. There must be sufficient strength of metal to withstand any tendency to elongate under this constant pressure.
3. The metal must be of absolute solidity, and denseness to hold the hydraulic pressure, and must be free of any defects such as slag or sand spots, shrinks, draws or blow holes.
4. The metal must be free cutting in order that machining costs may not be excessive.

Formerly it was the practice to use heavy bronze bushings in the caps to withstand the hydraulic pressure but, as this was so expensive, steps were taken to see if a metal could not be cast which would stand up without bushing. In addition to the above qualifications there was therefore another to be added which was that the metal poured into caps would also be satisfactory for miscellaneous machinery castings. As our work is varied and a cap would only take about 3000 lb. of metal from each heat it became necessary to pour the rest of our melt into jobbing work, and naturally we could not use such an analysis as would tend to make castings either hard or brittle.

Considerable thought was given to this subject, and many different classes of steel were considered and finally rejected for one reason or another. What we wanted was a metal which would fill the qualifications in a satisfactory manner, which was as cheap as possible to make, and which would require only a simple heat treatment to bring out its best properties. Finally two classes were selected as offering proper features: One a nickel steel, and the other a high manganese product. Comparative tests of these metals and a plain carbon steel are given in Table 1. These figures showed us that the steel with high manganese was very comparable to the nickel alloy, and this metal was accepted for trial. Our results from the first were fairly good and, after many minor difficulties, we were finally able to thoroughly standardize our process to the point where the product was eminently suitable from all angles.

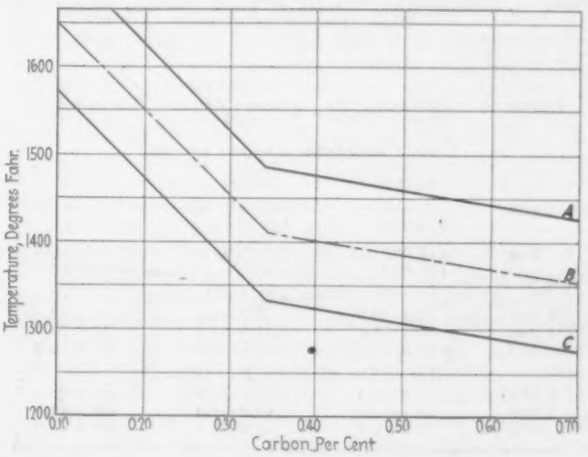
Our adopted analysis is carbon 0.25 to 0.30, silicon 0.25 to 0.30, phosphorus and sulphur under 0.05, and manganese 1.25 to 1.50 per cent. We later found that the analysis was the least of the troubles, and that the making of proper steel was something entirely different from that of producing ordinary castings. It was found that the presence of this high manganese content, while making an unusually good metal, caused the steel to become extremely sensitive and considerable trouble was encountered until its peculiarities had been mastered. It was found that the temperature of pouring was of extreme importance; the presence of any non-metallic inclusions in the steel caused trouble from cracks, and segregated spots; the steel did not need a harsh treatment to exhibit its best properties; and finally that the utmost care must be used in its manufacture from the raw scrap to the heat treating. The metal as produced today is indeed wonderful steel. There is absolute freedom from any cracking or segregation, the metal machines as well as a soft carbon steel, the hydraulic test has been raised to 8000 lb. and, best of all, the work on the job has proven satisfactory.

Furnace Practice for the Steel

The class of scrap used must be very carefully picked if results are to be good. In our first heats the scrap was taken as it came and caused endless trouble. If too clean, the heat would melt down high in carbon, manganese, and silicon, and would require heavy amounts of ore to cut these elements down. If the scrap was dirty it would melt down heavily oxidized. Either way it was found that the excess of oxide, even though supposedly eliminated in the furnace, would cause trouble later on, mainly coming to light as the cause of a cracked casting, or oftentimes as a porous spot in the metal. Experience showed that the most satisfactory charge was one containing about half returned shop scrap, and half clean boiler plate. This was charged with the shop metal on the hearth, the holes being filled with the plate, always attempting to obtain as compact a mass as possible. Two or three scoops of old molding sand were thrown in with the charge to furnish enough of a slag blanket to cover the bath, and prevent surface oxidation. Electrodes were carefully watched so that there was little likelihood of a stub breaking and raising the carbon during the melt down. Contrary to general practice we do not lute our doors during melting as this has a tendency to cause "snowing" with its attendant undue reduction and high results. The small slag body is sufficient to avoid any air reaching the metal.

The furnace being charged the current is thrown on the high tap and melting proceeds. As soon as a fair sized pool of metal is formed the furnace is carefully watched, especially the flame coming from around the electrodes. If melting under too much reducing atmosphere this flame will be very soft and luminous, accompanied by heavy clouds of white smoke. If this condition persists after five or ten minutes, small quantities of fine ore are added to thin the slag until the flame becomes sharper, accompanied by a yellowish brown smoke. If the heat is melting under heavy oxidizing conditions, the arc will be very irregular, the flame very sharp and bluish-brown and there will be either no smoke at all or very dense dark brown fumes. This is overcome by adding a little more slag. As soon as the heat is about three quarters melted a spoon is inserted and a test for slag taken.

From this point on is the crucial test of what the metal will be. If this slag is heavy and greenish, reduction has been too heavy and ore must be added, and the temperature of the metal kept down until conditions right themselves. If the temperature is allowed to increase the heat can never be reclaimed, and cannot be used in caps. Inversely if the slag shows a very



Heat Treatment Chart; Average Manganese Contents 1.25 to 1.50 Per Cent. *B* represents critical ranges for a plain carbon steel; *C* represents the theoretical critical ranges of a "cap steel" and *A* is the maximum allowable temperatures to which such a steel may be heated for treatment

The area between *A* and *B* is that which experience has shown to offer maximum results upon treatment

dull black, oxidizing conditions have been paramount and it will be necessary to carefully add small amounts of pig iron. The main point at this stage of the heat is to adjust the metal and slag under low temperatures. The correct slag on the melt down should be a very dark grey, in fact nearly a black, and should be very thin and opaque resembling lava in texture. As soon as these conditions exist the melt can proceed. When entirely melted all loose pieces should be raked from the walls, and a metal test taken and broken either for fracture, or to send to the chemist. If the heat has melted under the right conditions this test should show fairly sound, and contain approximately 0.12 to 0.15 per cent carbon, 0.03 to 0.05 per cent silicon, and 0.08 to 0.12 per cent manganese. While the test will not in any manner of means show finished metal it will not boil violently in the chill mold, and will show clear metal, free of blow holes around the rim of the test piece.

At this period the temperature of the metal will be low enough to still allow minor changes which may necessitate small amounts of either ore or pig. If the slag is very heavy it may even become necessary to rake most of it off and build anew. When the analysis is to the desired point six or eight large scoops of old dry molding sand are thrown in to make the finishing slag. I have found that this old refuse sand makes a better slag than any other class of material as it seems to fuse quickly and cleanly. The current is still kept on the high sides for about five minutes in order that the long arc may thoroughly mix up the slag. As soon as the temperature begins to increase this slag will begin to work on the metal, and the flame coming from the roof rings will gradually turn into a soft, luminous one showing that reduction is commencing.

The current is now thrown on to the low tap, and the final stages of the heat begins. Slag tests are now taken every three or four minutes, and it will gradually change from a dark brownish black to a very dark green. The slag will puff up and bright flames will be given off. This is the first good indication of deoxidation, and will be followed by the slag turning to a yellowish green, and stringing from the test spoon in long fingers. If the slag still remains thin and black

it needs more sand; if too thick and heavy small amounts of lime should be added. The slag in its proper condition will seem to be boiling when the door is opened. Metal tests taken now will show fairly clear around the rim, and with absolute freedom from gas holes, although the metal will rise slightly in the mold.

The heat is now in its correct chemical condition, and great care must be taken as regards temperature.

Table 1.—Comparative Results of Plain Carbon, Nickel and High Manganese Steels

Treatment: Oil quenched from critical point and drawn at deg. Fahr.:	Composition: Carbon 0.30% Mn. 1.50%	Composition: Carbon 0.30% Nickel 3.00%	Composition: Carbon 0.30% Mn. 0.60%
	Tensile Strength, Lb. per Sq. In.		
1,300	80,000 to 95,000	75,000 to 90,000	70,000 to 85,000
1,100	95,000 to 115,000	90,000 to 110,000	85,000 to 95,000
900	115,000 to 135,000	110,000 to 135,000	95,000 to 100,000
	Elongation, Per Cent		
1,300	27.5-30.0	28.0-30.0	30.0-32.0
1,100	20.0-23.0	22.0-26.0	23.0-28.0
900	15.0-20.0	18.0-22.0	20.0-23.0
	Reduction of Area, Per Cent		
1,300	55.0-60.0	64.0-68.0	60.0-65.0
1,100	50.0-55.0	60.0-64.0	55.0-60.0
900	40.0-50.0	55.0-60.0	50.0-55.0

Our only temperature test is taken by noticing the manner in which the steel pours over the side of the test spoon, and the amount of scull left. As soon as the steel pours clean from the spoon it is nearly ready to tap. Our practice on this metal is to hold for exactly five minutes and then take the final test. If all is right the ladle is called for.

Other melters have various methods of ascertaining temperature, but it must be remembered that this metal should be poured as "cold" as is possible. About three or four minutes before the heat is tapped the manganese is added to the furnace. This is calculated to 1.35 per cent and is in lumps about the size of the fist, in which condition it is thoroughly molten when the steel is poured. The pouring further tends to completely mix it with the metal eliminating any segregation. No carbon is added as that contained in the ferro-manganese is sufficient to raise at least 0.11 points or within the specification. Silicon at 0.15 per cent is added in wheat size to the ladle being placed in a paper bag, and thrown directly under the molten stream. This should be added when the ladle is about half full. If thrown in too early it will scull the bottom; if too late it will not have a chance to thoroughly mix.

Should it ever become necessary to recarbonize this is always done by means of pig iron added as long before the pour as is possible in order not to disturb the temperature. If the heat has been carefully watched and properly melted there is very seldom any need for this. I am not at all in favor of lowering the electrodes immediately before the pour and allowing the molten metal to absorb carbon. This is very careless practice as there are so many variables which will change results, such as temperature of metal, depth of slag, depth of insertion, area of electrodes, etc. Furthermore, with electrodes at about 6 to 7c per lb., this is expensive carbonizing.

To briefly summarize the salient points in melting:

1. Scrap must be carefully picked and charged.
2. Small amount of slag making material must be charged on the furnace hearth.
3. Melting must proceed carefully, always tending to keep the temperature as low as possible until conditions are ready for finishing the heat.
4. Take plenty of slag and metal tests in order to closely follow the progress of the heat.
5. Should it be necessary to add either ore or pig do so in small amounts until melt is of correct composition.
6. Use pig of low phosphorus content for all recarbonizing.
7. Add all manganese to furnace at least three or four minutes before tapping.
8. Use no aluminum in the ladle or mold whatsoever.

Bottom pour ladles are used exclusively for pouring, and the metal is held in the ladle for at least five minutes before the nozzle is opened. Upon first opening up the stream the metal is allowed to run in the mold rather fast until 200 or 300 lb. has passed, when the flow is choked and the mold filled as slow as is consistent with the proper running of the casting. In this manner absolute freedom from slag is obtained; there is very little danger from cold shutting or seams; the metal sets rapidly, eliminating cracks, tears or shrinks; and the surface of the work cleans readily.

In the preparation of the mold the greatest care is used. The sand used is carefully examined, and after being molded the cope and drag are both thoroughly dried in an oil-fired drying oven. Contrary to general practice no nailing is used except in the vicinity of the gate. The mold is gated down through the large center core, and so arranged that the downcoming metallic stream impinges on a boiler steel plate. This has been found to be very important, as the metal dropping over 4 ft. is very apt to seriously scab the runner, allowing sand inclusions to arise in the casting.

Table 2.—Results of Various Treatments on a Steel Averaging Carbon 0.25 to 0.30 Per Cent, and Manganese 1.25 to 1.30 Per Cent

Treatment, Deg. Fahr. Water	Drawn	Tensile Strength, Lb. per Sq. In.	Elongation, Per Cent	Bend, Deg.
1,700	1,300	103,200	4.7	...
	1,100	106,700	3.0	...
	900	121,000	2.7	...
1,600	1,300	97,500	10.2	90
	1,100	102,000	8.0	30
	900	115,000	7.5	30
1,550	1,300	94,000	12.1	120
	1,100	98,500	6.3	40
	900	107,400	6.1	30
1,500	1,300	93,000	11.1	120
	1,100	96,300	7.9	60
	900	98,900	6.8	60
1,450	1,300	98,000	12.0	100
	1,100	102,400	9.1	75
	900	109,600	5.3	30
1,400	1,300	86,000	7.2	45
	1,100	89,300	5.1	...
	900	91,100	4.0	...
1,300	1,300	88,100	8.3	...
	1,100	90,500	8.0	...
	900	93,200	7.7	...
Annealed from:				
1,700		92,000	11.0	120
1,600		90,000	17.5	130
1,500		88,500	18.5	150
1,400		82,000	13.2	90
Oil	Drawn			
1,700	1,300	101,100	8.5	60
	1,100	103,650	8.1	50
	900	109,300	6.8	30
1,600	1,300	90,000	19.7	180
	1,100	93,500	18.9	180
	900	100,250	16.3	120
1,500	1,300	94,400	21.2	180
	1,100	94,900	20.0	180
	900	99,750	17.5	150
1,450	1,300	92,200	21.4	180
	1,100	91,700	20.2	180
	900	96,400	18.7	160
1,400	1,300	84,000	13.3	90
	1,100	86,500	12.7	90
	900	83,750	9.5	60
Air				
1,700	1,300	92,000	9.5	90
	1,100	94,400	9.3	90
	900	97,350	8.9	60
1,600	1,300	91,750	22.5	180
	1,100	94,000	21.7	180
	900	96,250	20.3	180
1,500	1,300	89,600	24.0	180
	1,100	91,500	22.7	180
	900	92,000	19.6	180
1,400	1,300	82,700	14.1	120
	1,100	84,000	12.2	120
	900	84,500	11.9	90

There are two heads of sufficient size to avoid any possible chance of shrinkage, and a little fresh metal is poured in each head before leaving the job. If the piece has been poured correctly and the temperature of the metal is right the steel should be set in the

pouring cup not over two or three seconds after the ladle is shut off.

The casting is allowed to cool in the mold over night, is shaken out and passes to the acetylene station where the heads and runner gate are cut off. The sand blast is the next step where all adhering sand is removed. The casting is then ready for the heat treatment.

Heat Treating the Castings

These castings are handled three at a time in the treating process. They are placed on the car, run into the oven, the door carefully closed, and the heat started. The oven is oil-burning and so arranged that the flame enters at the bottom, and passes up both sides and around the steel. The flame at no time impinges on the metal. Manganese has the property of lowering the critical range of steel approximately 5 deg. Fahr. for each 0.10 per cent. With a steel of 1.50 per cent manganese this would amount to 75 deg. We have found, however, that heating to slightly higher temperatures tends to improve the metal, and consequently the work is treated with the same temperatures as would be used for a plain steel of the corresponding carbon content.

On determining the proper temperatures of heating, different experiments were conducted under perfect conditions. Sets of test bars of standard size were cast, as were bars for bend tests. These were treated in a small electric annealing furnace under varying conditions and temperatures, all work being closely checked with a pyrometer. There were four main tests made:

1. Quenching in water from 1600, 1550, 1500, and 1450 deg. Fahr., and drawing at 1300, 1100, and 900 deg.
2. Quenching in oil at same temperatures.
3. Quenching in an air blast as above.
4. Plain annealing.

Our results from these tests were quite varied as might well be expected. The first result of importance was that results of practically equal worth were obtained from all of the quenching temperatures. This at first seemed strange and rechecks were made not only at the above temperatures, but also at 1400, 1300, and 1700 deg. It was found that below 1450 deg., results were very low on tensile strength, while at 1700 deg. the elongation was seriously impaired. Quenching temperatures of from 1450 to 1600 deg. gave the same closeness of results. This was encouraging, as it meant that soaking temperatures could be more easily controlled without overheating the metal.

The next development was the comparison between the different quenching mediums. Water proved too harsh, the tendency being for low elongations regardless of the drawing temperature. Oil and air proved about equal, with the balance in favor of the air. Plain annealing did not seem to bring out any of the beneficial properties of the manganese at all, and was quickly discarded.

From these results it was decided to try different drawing temperatures after an air quench with the result that from 1200 to 1300 deg. proved to give maximum results. Upon practical trial this system proved acceptable. Strengths were as high as necessary, the toughness of the metal on the bend test was apparent, and the steel machined quite readily.

The castings are very slowly brought up to a point where the furnace pyrometer shows 1550 deg. Fahr., and are allowed to soak as close to this figure as possible until the heat is thoroughly diffused. The heating will take approximately 4 hr. and the soaking from two to three. The car is rapidly withdrawn and a stream of air played on the castings until nearly black. They are then again placed under the heat and brought to 1250 deg., allowed to soak for about an hour and allowed to cool down in the oven.

After machining the castings are tested under hydraulic pressure at 8000 lb., and are again placed in the treating furnace and heated up to about 600 deg. to help relieve any machining strains, when they are ready for the job.

From our results on this metal we have obtained a very interesting insight into its qualifications, and believe there are many other types of casting for which it is eminently suited. For any work requiring a steel of great toughness, combined with good strength, it seems extremely suitable, and at the same time is cheap to make. The greatest care, however, must be observed to avoid difficulties.

Pearlitic Cast Iron

The interest in Germany in so-called pearlitic cast iron continues as shown by a recent article in *Die Giesserei*, and by mention of this material at the recent convention of foundrymen in Germany. Dr. Bauer's paper on this subject was abstracted in THE IRON AGE, Aug. 16, 1923, the method being to cast metal of carefully determined composition in heated molds.

The article in *Die Giesserei* is by Dr. H. Frei of Zurich, and gives the methods followed at Brown, Boveri & Co. in Baden, Switzerland. Special molds are not used but great care is paid to the composition of the metal, produced in an electric furnace mainly from steel scrap, and also to the pouring temperature. Photomicrographs are given in the original article showing a matrix of well laminated pearlite in which is a well developed network of graphite.

At the Brown, Boveri plant, through exact regulation of these conditions, the following tests of good workable iron were guaranteed:

Tensile strength	45,500 lb. per sq. in.
Bending strength	71,100 lb. per sq. in.
Compressive strength	142,300 lb. per sq. in.

These guaranteed strengths have already been exceeded, giving regularly 51,200, 78,200, and 159,300 lb. per sq. in. respectively. From 40 to 60 tons per month of such special iron is being made in the form of castings. To obtain such excellent test results the foundry superintendent at Brown, Boveri believes the total carbon should be from 3.0 to 3.1 per cent, the silicon about 1.5 per cent, and the manganese 0.70 to 0.80 per cent. Because of the high temperatures available with the electric furnace a thin liquid iron can be obtained with phosphorus not over 0.10 per cent and the harmful effect of the phosphide eutectic is avoided. In regard to sulphur it is believed that a certain amount is desirable, and the lower limit may be placed provisionally at 0.035 per cent, which is easily obtained with the basic lined electric furnace.

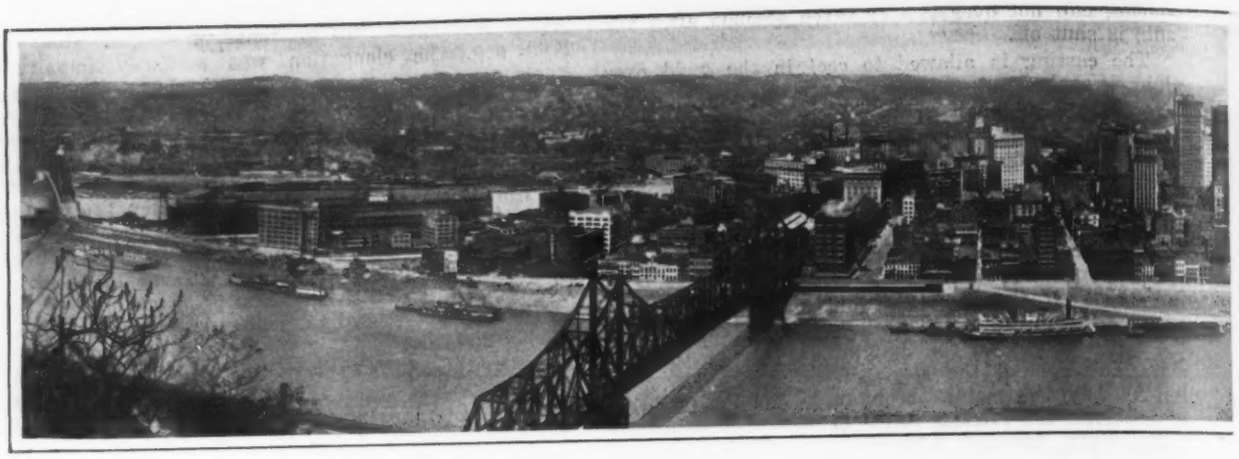
An iron with total carbon 3.08 per cent, graphite 2.08, silicon 1.62, manganese 0.79, phosphorus 0.096, and sulphur 0.037 per cent gave 49,900 lb. per sq. in.; and another with total carbon 3.03, silicon 1.65, manganese 0.77, phosphorus 0.128, and sulphur 0.033 per cent, gave 51,050 lb. per sq. in.

The furnace used is briefly described as being 3 to 5 tons and similar to a Heroult three-phase type with three electrodes. A distinctive electrode regulator is used on a hydraulic principle. The charges are made up of steel scrap, cast iron turnings, etc., with ferrosilicon used to regulate the silicon. The time is 8 to 10 hr., and the current consumption per ton of finished castings is 800 to 900 kw. G. B. W.

Story of Aluminum Industry

The importance of aluminum in the present stage of civilization and the development of this industry since the discovery of the metal in a chemical laboratory in 1827, are graphically told in the current issue of *Lehigh Leaflets*, one of the publications of Lehigh University, Bethlehem, Pa.

Any account of the aluminum industry must necessarily record the part played in its commercial development by Dr. Joseph W. Richards, for over 30 years associated with all phases of aluminum production and who at the time of his death in December, 1921, had been professor of metallurgy at Lehigh University for 18 years.



Steel Treaters' Week at Pittsburgh

Fifth Annual Convention and International Exposition of the American Society for Steel Treating, Oct. 8 to 12

FOUR years ago in Chicago the first convention and steel exposition of the newly formed society —since named the American Society for Steel Treating—was held. This took place in September, 1919. The growth of this society has been the outstanding development in the history of American technical organizations.

The fifth annual gathering is to be held this year in Pittsburgh under the auspices of the Pittsburgh chapter during Oct. 8 to 12, and there seems to be no doubt that it will surpass the eminently successful one held in Detroit last year.

A new arrangement has been made this year regarding the time of holding the technical sessions. For the first time the exposition will not be open during the morning technical sessions, which are to be held at the William Penn Hotel, six miles from the exposition, which is housed at Motor Square Garden. At the latter place in the afternoons special programs for round table discussions and symposiums have been scheduled. The successful symposiums of last year—on hardness testing and on metallurgical education—are to be continued.

The issue of THE IRON AGE for Sept. 27 published seven specially contributed articles dealing with heat treatment subjects. General details follow.

List of Exhibitors and Products Exhibited

A

AIR REDUCTION SALES CO., New York. General line of welding and cutting equipment; also demonstrations of straight line and circular cutting and combinations of both with the Radiagraph; angular cuts by means of a circular cutting device known as the Holograph, adapted for use with the Radiagraph; also demonstrations of work done by the Oxygraph, such as production cutting of crank shafts from steel slabs; demonstrations of the Camograph roughing out steel gears of fairly coarse pitch as well as any other repetitional production work, where the removal of large quantities of steel at low cost is required. Represented by G. Van Alstyne, F. E. Rogers, Harold Grow, W. A. Warfel and Alexander Blaser.

AMERICAN CAR & FOUNDRY CO., New York. One No. 3 three-electrode Berwick electric rivet heater; one No. 4 two-electrode end-rod heaters, and one 4-ft. rod heater. Represented by John S. Helt, W. C. Helt and F. C. Cheston.

AMERICAN STAINLESS STEEL CO., Pittsburgh. Articles made from stainless steel, including automobile parts, castings, cutlery, dies, golf clubs, harness fittings, springs, surgical instruments, turbine blades, wire, etc. Represented by John C. Neale, president, and C. S. Bunting, secretary.

AMERICAN TOOL WORKS CO., Cincinnati. One 14 in. x 6 ft. American high-duty tool room lathe with three-step cone, double back geared head, taper attachment, oil pan, universal relieving attachment, draw-in attachment with set of collets, shear wipers on carriage and carriage micrometer stop; one 3-ft. American triple-purpose plain radial drill, with plain box table and six change speed box arranged for belt drive; one 24 in. x 12 ft. American heavy pattern, high-duty lathe, with patented 12-speed geared head arranged for motor drive, shear wipers on carriage and high-duty tool box, to be driven by 15 hp., 1160 r.p.m., 220 volt, 3 phase, 60 cycle, type CS, frame 460 C, Westinghouse motor, with type AF auto starter and start and stop push buttons; also 6 ft. radial drill. Represented by H. W. Schatz and F. L. Stubenroth.

ARMSTRONG-BLUM MFG. CO., Chicago. Marvel hack saw machines, automatic high-speed band saw, punching, shearing and bending machine; all machines in operation. Represented by Harry J. Blum, secretary.

ARMSTRONG CORK & INSULATION CO., Pittsburgh. Nonpareil insulating brick for the insulation of furnaces and ovens; Nonpareil high-pressure covering, blocks and cement for high temperature insulation; Nonpareil cork covering for refrigerated lines and tanks; Nonpareil cork board for cold storage rooms, and Linotile and Armstrong's cork tile floors. Represented by R. S. Findley, L. W. Bertelsen and F. C. Young.

E. C. ATKINS & CO., Indianapolis. Silver steel saws, saw tools and saw specialties, including metal-cutting circular saws for every purpose; AAA non-breakable hack saw blades, AAA power blades, hack saw frames, hack saw machines, metal band saw cut-off machines, band saws, planer knives, belt wax, dado heads, special groovers and cutters as used by the foundry and steel treating trade. Represented by E. S. Norvell, W. H. Albaugh and W. L. Sturtevant.

ATLAS STEEL CORPORATION, Dunkirk, N. Y. Showing applications of tool steels and special steels, articles made from the company's steels and exhibits of fractures of steels in various conditions. Represented by Howard Reese, district manager of sales of Pittsburgh district.

AVEY DRILLING MACHINE CO., Cincinnati. Three drilling machines—a No. ½ machine with speeds up to 12,000 rpm.; three-spindle No. 2 machine with one-spindle hand feed and tapping attachment, one-spindle semi-automatic feed and one-spindle full automatic feed; single-spindle No. 3 machine with power feed. Represented by J. G. Hey, vice-president, and J. F. Mirrieless, general superintendent.

B

BAKER BROTHERS, Toledo, Ohio. No. 121 heavy-duty drilling and boring machine in booth of Motch & Merryweather Co., Cleveland, which is Baker Brothers' selling agent. Represented by W. W. Elliott and H. L. Tigges.

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Metallurgical microscopes and metallographic equipment, featuring several new models of the latter ranging from simple equipment to the larger equipment used for research work.

BELLEVUE INDUSTRIAL FURNACE CO., Detroit. A vertical muffle-type, high-speed hardening furnace equipped with a carborundum muffle and working in connection with a Geissinger fuel control and Brown recording instruments; also a tilting-type aluminum melting furnace, both in operation. Represented by Walter E. Hinz and Louis J. Raymo, sales manager.

BELLIS HEAT TREATING CO., New Haven, Conn. Operating demonstration of the triple-unit Lavite furnace for high-speed hardening of steel tools. Represented by A. E. Bellis, president, and J. W. Black.

BETHLEHEM STEEL CO., Bethlehem, Pa. Exhibit showing quantities of the various materials which enter the coke ovens, blast furnaces and open-hearth, together with the quantities of the different materials obtained from each. Represented by R. M. Bird, A. P. Spooner, R. H. Christ, A. D. Shankland, W. L. Trumbauer, Henry Wysor, C. E. Chamberlain and G. A. Richardson.

THE BRISTOL CO., Waterbury, Conn. Standard line of recording instruments for pressure, vacuum, temperature, electricity, time, motion, etc.; also the new Bristol-Fuller controller valve for use in connection with temperature control. Represented by Roy M. Walker, Pittsburgh district manager.

BROWN INSTRUMENT CO., Philadelphia. Standard line of Brown indicating and recording pyrometers, thermometers, pressure gages and tachometers, and the following new instruments: Brown hydrogen ion recorders for recording alkalinity and acidity; oxygen content recorders; indicating and recording temperature control, signaling and alarm instruments; also the new Brown electric CO-2 recorder, which, it is claimed, does away with the limitations of CO-2 recorders operated on other principles. Represented by George W. Keller, sales manager; G. L. Clapper, Pittsburgh district manager; F. Q. Thorp, Cleveland district manager; D. C. Mayne, Columbus, Ohio, district manager; A. C. Hanson, Pittsburgh district representative; P. E. Hemmerle, pyrometer engineer; C. L. Simon, technical director of advertising; M. M. Watkins, special representative.

BUREAU OF STANDARDS, U. S. Department of Commerce, Washington. Showing equipment available at the Bureau of Standards for research work and testing, illustrating the fields of cooperation with various industries; also standard chemical samples, a set of the bureau's precision gage blocks, a relatively large number of samples to illustrate metal spraying; photographs, transparencies and a projection lantern in continuous operation to show as completely as possible the field of activities at the bureau. Represented by Dr. G. K. Burgess, director; H. J. French, T. G. Diggs and O. Z. Klopsch.

C

CALORIZING CO., Pittsburgh. Calco recuperators; also specimens of powder calorizing and dip calorizing; also a few samples of Calite, the company's high heat-resisting alloy. Represented by B. L. Jarrett, G. D. Mantle, J. S. Stairs, Harry Miller, B. J. Sayles, E. L. Malone, A. V. Farr and G. L. Davis.

CASE HARDENING SERVICE CO., Cleveland. Exhibiting Bohnite, a case hardening compound, and Caseite, a cyanide hardening compound; also a new product known as Non-Case, which is a paint for protecting steel from carbonizing gases during the case hardening process. Represented by W. C. Bell, E. J. Gossett and J. S. Ayling.

CELITE PRODUCTS CO., Chicago. Sil-O-Cel heat insulation, brick, block, concrete, powder and cements; a blow torch showing a flame playing continuously on a Sil-O-Cel brick to illustrate its impenetrability to heat; also a small heat treating furnace showing the application of Sil-O-Cel insulation to various forms of equipment. Represented by W. T. Kennedy of company's Pittsburgh office.

CENTRAL STEEL CO., Massillon, Ohio. Enlarged photographs showing plant operations; also a completely assembled transmission together with a display of various finished parts made from Agathon alloy steels. Represented by Earl C. Smith, chief metallurgical engineer; F. J. Griffiths, president and general manager; J. M. Schlendorf, vice-president in charge of sales; B. F. Fairless, vice-president in charge of operations; C. P. Richter and W. W. Leffler, metallurgists.

CHICAGO FLEXIBLE SHAFT CO., Chicago. An oven furnace and also a new type furnace for use with liquid heating media in connection with the hardening of high-speed steel. Represented by Peter Blackwood, sales manager, assisted by O. C. Bernhard, Pittsburgh representative, and J. W. Lazear, district manager, New York.

CINCINNATI GRINDER CO., Cincinnati. One 12 x 36-in. Cincinnati universal grinder; one Cincinnati centerless grinder; separate units of Cincinnati universal grinder, comprising one heavy-duty headstock, one automatic reverse plate and one speed change gear box; exhibit in conjunction with that of Cincinnati Milling Machine Co. in booth of the Motch & Merryweather Machinery Co. Represented by Arthur C. Hoefinghoff, Walter W. Tangeman, John Caster, Walter F. Stegner and Learn Johnson.

CINCINNATI MILLING MACHINE CO., Cincinnati. No. 4 vertical milling machine of new type, a No. 2 universal milling machine with the new rectangular overarm, a cutter grinder, a newly designed centerless grinder and a new universal grinder of the 12 x 36-in. size. Represented by J. E. Caster, Middle West representative; W. W. Tangeman and L. V. Johnson.

CLIMAX MOLYBDENUM CO., New York. Literature on molybdenum steels covering products used by automobile companies, railroads, the forging industry and for tool steels, steel rolls and castings and other purposes; also products of molybdenum steel by the following companies: A. Finkl & Sons Co., Wood Shovel & Tool Co., Cox Bumper Co. and King Pneumatic Co. Represented by B. F. Phillipson, president; J. D. Cutter, vice-president and metallurgist; W. N. Bratton, sales metallurgist; C. F. Blue, G. O. Loeffler and R. C. Purkhiser, Pittsburgh representatives of the Climax Molybdenum Co.

COLONIAL STEEL CO., Pittsburgh. Samples of crucible and high-grade open-hearth steel illustrating mill practice, heat treating methods, etc. Represented by Lawrence Wood, Pittsburgh district sales manager.

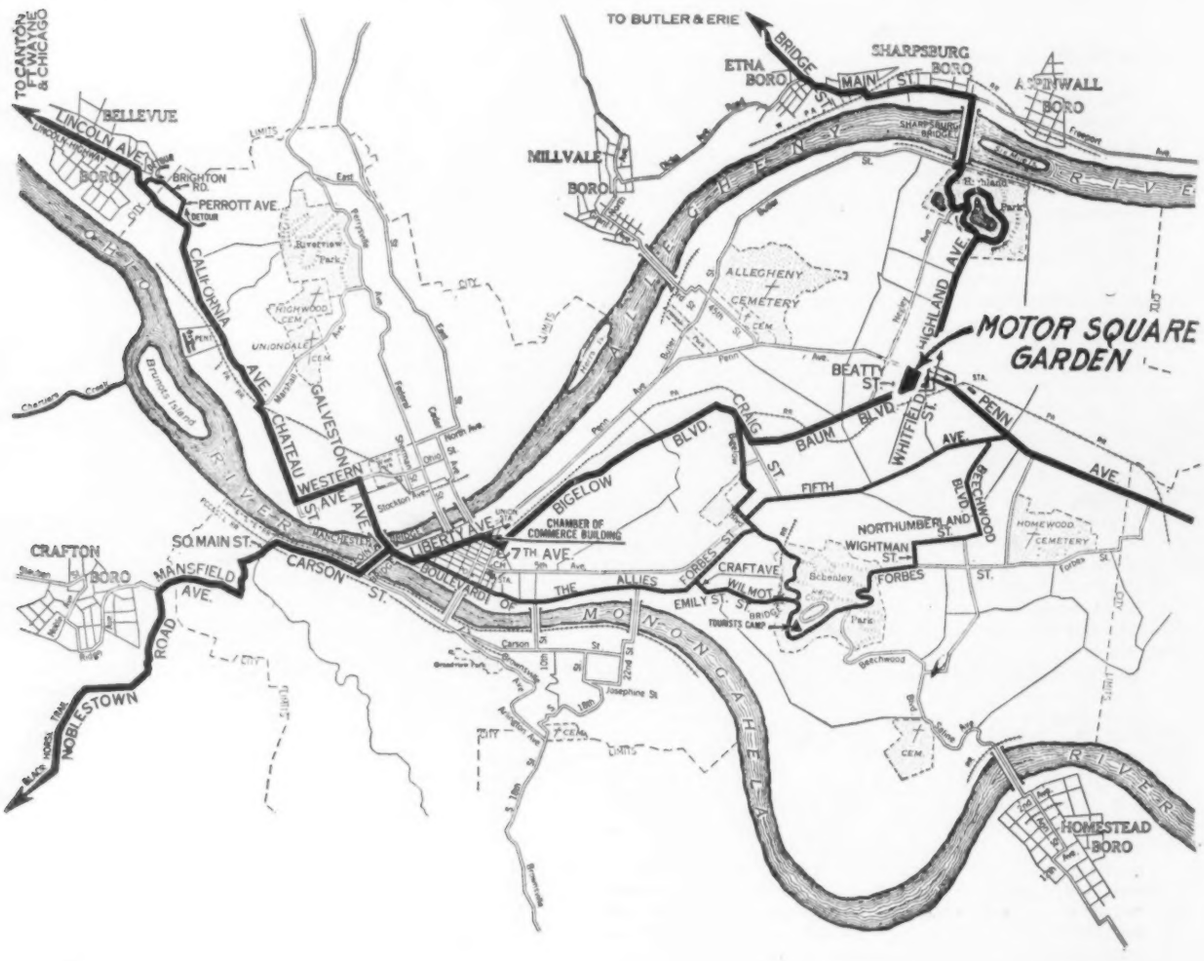
COMBUSTION UTILITIES CORPORATION, New York. Recuperative heat treating and forging furnaces. Represented by W. B. Kopfer, H. M. Henry and F. W. Manker.

CRUCIBLE STEEL CO. OF AMERICA, New York. Crucible and alloy electric steels in various tool forms, with several illustrations to show the evolution of well known tools

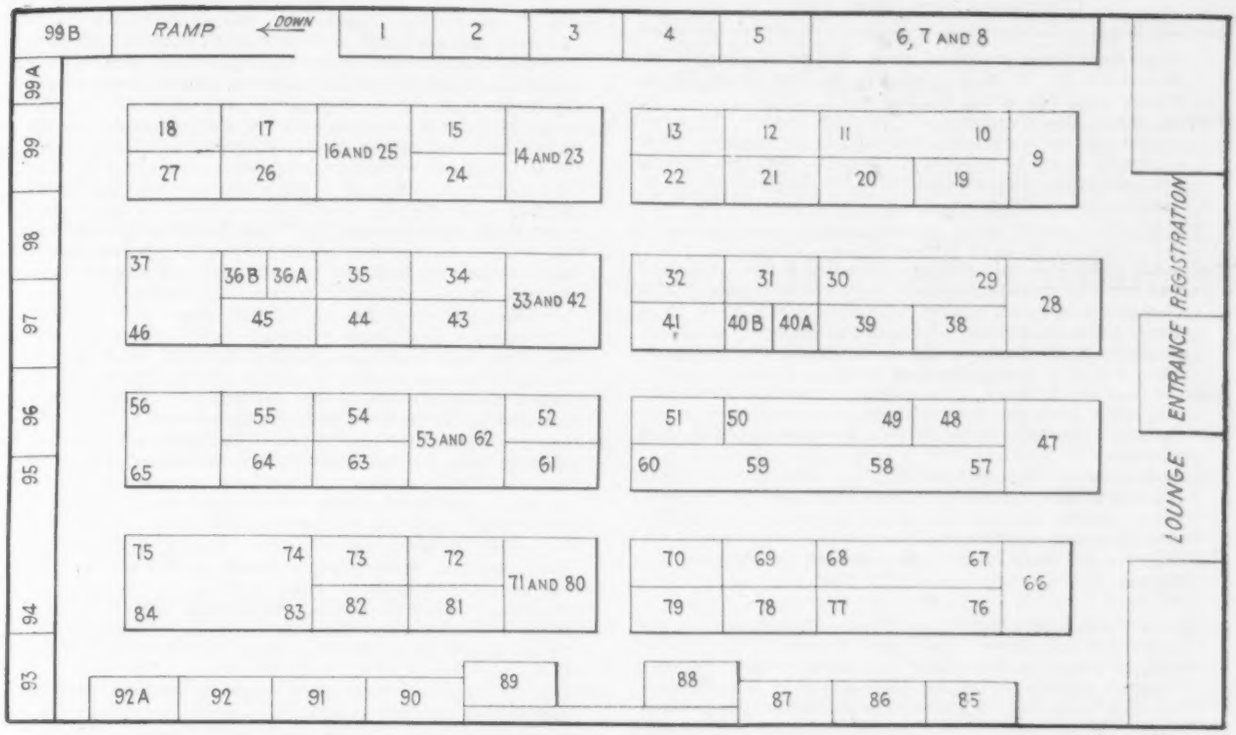
(*Continued on page* 830)

List of Exhibitors and Their Location

	Space No.
Air Reduction Sales Co.	S137
American Car & Foundry Co.	69
American Gas Furnace Co.	S105
American Stainless Steel Co.	S116
American Tool Works Co.	92
Andresen & Associates, Inc.	S142
Armstrong-Blum Mfg. Co.	78
Armstrong Cork & Insulation Co.	52
Atkins & Co., E. C.	S123
Atlas Steel Corporation	19
Avey Drilling Machine Co.	59
Babcock & Wilcox Tube Co.	S107
Bacharach Industrial Instrument Co.	99B
Baker Bros.	89
Bausch & Lomb Optical Co.	5
Bellevue Industrial Furnace Co.	96
Bellis Heat Treating Co.	36A
Bethlehem Steel Co.	14 & 23
Blanchard Machine Co.	85
Bristol Co.	99
Brown Instrument Co.	9
Bullard Machine Co.	87
Bureau of Standards	S104
Calorizing Co.	47
Carnegie Institute	S149
Case Hardening Service Co.	38
Celite Products Co.	1
Central Steel Co.	35
Champion Sales Co.	S112
Chicago Flexible Shaft Co.	98
Cincinnati Grinder Co.	90
Cincinnati Milling Machine Co.	90
Cleveland Steel Tool Co.	36B
Climax Molybdenum Co.	53-62
Colonial Steel Co.	33 & 42
Combustion Utilities Corporation	94-95
Crescent Washing Machine Co.	93
Crucible Steel Co. of America	13
Cutler Steel Co.	S111
Davison Gas Burner & Welder Co., N. C.	99A
Dearborn Chemical Co.	41
Dempsey Furnace Co.	97
Disston & Sons Co., Henry	S115
Driver-Harris Co.	4
Electrical Refractories Co.	S101A
Engelhard, Inc., Chas.	32
Equitable Gas Co.	S130
Federal Machine & Welder Co.	S119
Finkl & Sons, A.	62
Firth-Sterling Steel Co.	3
Ford Co., J. B.	31
Forging, Stamping and Heat Treating	43
General Alloys Co.	28
General Electric Co.	76-77
Giddings & Lewis Machine Tool Co.	86
Goddard & Goddard Co.	79
Gould & Eberhardt	80
Hagan Co., George J.	66
Halcomb Steel Co.	22
Hamilton & Associates	S102
Haskins Co., R. G.	S141
Hauck Mfg. Co.	18
Haynes Stellite Co.	51
Heppenstall Forge & Knife Co.	6-7-8
High-Speed Hammer Co.	S109
Holcroft & Co.	S143
Homestead Valve Co.	S101
Hoover Steel Ball Co.	S100
Hoskins Mfg. Co.	
Houghton & Co., E. F.	45
Hunter Saw & Machine Co.	S125
International Nickel Co.	37 & 46
Interstate Iron & Steel Co.	50
Iron Age	21
Iron Trade Review	73
Jones & Laughlin Steel Corp.	26
Keller Mechanical Engraving Co.	89
King Refractories Co.	44
Kinite Co.	S114
Kleist & Co., Chas.	40B
Laughlin & Barney Machinery Co.	57-58-59
Leeds & Northrup	71 & 80
Leitz, Inc., E.	S110
Linde Air Products Co.	S117
Ludlum Steel Co.	56 & 65
Machinery	40A
Mahr Manufacturing Co.	54
Matthews & Co., Jas. H.	2
McCoy-Brandt Machinery Co.	S121 & S122
Midvale Co.	81
Molybdenum Corporation of America	27
Motch & Merryweather Machinery Co.	82
Included in this are booths 85 to 92	
National Automatic Tool Co.	91
National Machinery Co.	12
National Twist Drill & Tool Co.	S136
Nuttall Co., R. D.	S113
Obermayer Co., S.	63
Ohio Machine Tool Co.	60
Ohio Steel Foundry Co.	15
Oilgear Co.	58
Oliver Instrument Co.	59
Olsen Testing Machine Co., Tinius	72
Pangborn Corporation	74-75 & 83-84
Pannier Bros. Stamp Co.	S126
Park Chemical Co.	S108
Peerless Machine Co.	S135
Pennsylvania Pump & Compressor Co.	92A
Pittsburgh Crucible Steel Co.	S120
Pittsburgh Instrument & Machine Co.	S124
Quigley Furnace Specialties Co.	61
Racine Tool & Machine Co.	S140
Rockwell Co., W. S.	24
Rodman Chemical Co.	20
Roessler & Hasslacher Chemical Co.	S131
Ryan Co., F. J.	S132
Scientific Materials Co.	S128
Shore Instrument & Mfg. Co.	S133
Spencer Turbine Co.	64
Steel City Testing Laboratory	S150
Surface Combustion Co.	17
Swindell & Bros., William	S103
Tacony Steel Co.	48
Tate-Jones & Co., Inc.	S129



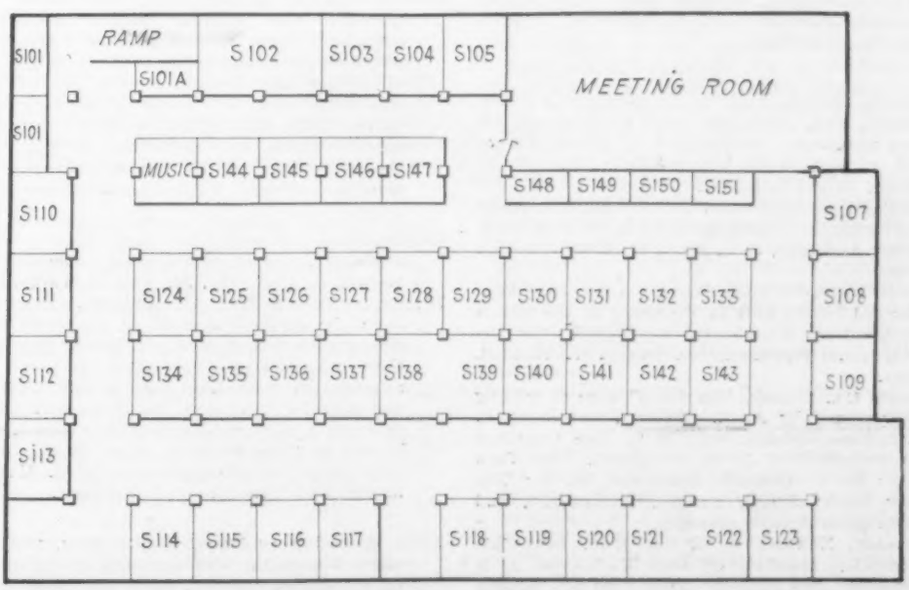
Location of the Exposition—Motor Square Garden—with reference to the Center of Pittsburgh



Location of Exhibitors' Booths on the Main Floor of Motor Square Garden

	Space No.
Taylor Instrument Cos.	34
United Alloy Steel Co.	10-11
Union Electric Steel Co.	55
U. S. Chain & Forging Co.	S134
V & O Press Co.	86
Vanadium-Alloys Steel Co.	29-30
Vanadium Corporation of America	16 & 25
Vulcan Crucible Steel Co.	S127
Warner & Swasey Co.	S118
Westinghouse Electric & Mfg. Co.	67-68
Wilson-Maeulen Co.	S138-S139
Witherow Steel Co.	39

Motor Square Garden Where the International Steel Exposition Is to Be Held



Location of Exhibitors' Booths in the Basement of Motor Square Garden

(*Continued from page* 827)

made from these grades of steel. Represented by R. A. McDonald, Dr. C. N. Johnson, A. E. Van Cleve, M. S. Dravo, C. E. Hill and J. W. Taylor.

CUTLER STEEL CO., Pittsburgh. Complete line of the company's heat-resisting alloy, Duraloy, in the various forms in which it is manufactured, namely, castings, sheets, bars and wire. Represented by W. H. Waddington, A. S. Lambie, W. F. Furman, F. B. Foster and T. R. Heyward, Jr.

D

DEARBORN CHEMICAL CO., Chicago. No-Ox-Id rust preventative compound; Klean-Kleen, a powdered cleaner, and Dearboline, a liquid cleaner. Represented by E. M. Converse, Chicago, director of specialties department; J. A. Crenner, E. K. Thomas and C. C. Brown of Pittsburgh office and C. I. Loudenback of Detroit office.

HENRY DISSTON & SONS, Philadelphia. Disston metal-cutting saws, tools and files, with metal-cutting saws in operation. Represented by Messrs. Dorrington, Ludy and Newman.

DRIVER-HARRIS CO., Harrison, N. J. Cast Nichrome carbonizing containers, furnace muffles, furnace parts, conveyor chains, retorts, pyrometer protection tubes, Nichrome sheets and Nichrome in various other forms for high temperature work. Represented by H. D. McKinney.

E

CHARLES ENGELHARD, INC., New York. Indicating and recording thermo-electric pyrometer instruments in operation for both rare-metal and base-metal types of thermocouples; electric resistance thermometers, both indicating and recording types; automatic temperature regulators in connection with thermo-electric pyrometers, electric resistance thermometers and thermostats, these including electric circuit breaker panels, solenoid operated valves, motor operated valves and a new type mercury circuit breaker; indicating and recording instruments for gas analysis, operated on the principle of thermal conductivity; autographic instrument for measurement of temperature coefficient of expansion; a complete line of Impervite refractory porcelain in the form of crucibles, boats, combustion tubes, pyrometer tubes, etc. Represented by J. H. Allison, E. J. Deckman and E. S. Newcomb.

EQUITABLE GAS CO., Pittsburgh. Photographic reproductions of various furnace installations; a corps of engineers to give advice regarding the use of gas for heat treating and other purposes. Represented by R. E. Polk, C. H. Whitwell, E. F. Koch and C. J. Long.

F

FIRTH-STERLING STEEL CO., McKeesport, Pa. Samples of Blue Chip high-speed steel, Firth-Sterling special tool and die steel and Firth-Sterling stainless steel. Represented by Edwin T. Jackman, in charge; D. G. Clark, A. C. Leete, Robert Kimber, A. E. Barker, H. I. Moore, Charles Von Schlutter, Harry Jarvis, Frederic Jarvis, D. E. Jackman, Jr., G. J. Bauer, H. S. Norman, W. A. Nungester, W. C. Royce, L. E. Tegardine, J. A. Wotan, T. A. Larecy, R. H. Hallagan and M. E. Burkemer.

J. B. FORD CO., Wyandotte, Mich. Wyandotte cleaning specialties and a specimen air agitation tank. Represented by B. N. Goodell, Wyandotte; C. S. Tompkins, Detroit, and J. H. Smith, Pittsburgh.

G

GENERAL ALLOYS CO., Boston. Full line of carbonizing boxes, lead and cyanide pots, pyrometer tubes and castings for heat resisting purposes. Represented by H. H. Harris, president; E. P. Van Stone, vice-president, and W. K. Leach, assistant to the president.

GENERAL ELECTRIC CO., Schenectady, N. Y. Three electric heat treating furnaces. Represented by A. N. Otis, E. F. Collins, Walker Anderson, C. L. Scott, R. A. Tophan and C. T. McLoughlin.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis. No. 32 horizontal boring mill in the space of the Motch & Merryweather Co. Represented by George Cole, the company's Cleveland representative, and E. V. Wenzell, sales manager.

GODDARD & GODDARD CO., Detroit. "Go & Go" type of milling cutters. Represented by A. N. Goddard, president; C. H. Wallace, railroad demonstrator; R. T. Rice, Ohio and Pittsburgh representative; J. W. Sederquist, New York representative; E. E. Guntert, Rochester, N. Y.; Dix Proctor, New York; Joseph Sample, Philadephia, and C. S. Goddard, general sales manager.

GOULD & EBERHARDT, Newark, N. J. A 32-in. Invincible shaper in operation, roughing off steel die blocks. It is possible to operate this machine from 9 to 115 strokes per min., according to the manufacturers. Represented by Albert Miller, demonstrator.

H

GEORGE J. HAGAN CO., Pittsburgh. Standard electric heat-treating furnace; also a supply of literature describing various installations of electric furnace equipment that have been made within the past few years. Represented by R. E. Talley, C. F. Cone and A. D. Dauch.

HALCOMB STEEL CO., Syracuse, N. Y. A complete line of tool, alloy and special steels; also dies and tools shows uses to which company's tool steel may be put, and products from company's alloy steels, including automobile and airplane crank shafts, cam shafts, gears, connecting rods, springs, etc.; also products of the company's wire mill in cold drawn wire, drill rod and special shapes both in tool and alloy steels. Represented by Messrs. Stagg, Galbraith, Kirwan, Talmage, Schroeder, Atkinson, Schnibbe, Boland and Spalding.

R. G. HASKINS CO., Chicago. Flexible shaft equipments and portable tools used for die sinking and drop forging work, as well as in other branches of the steel industry; also a working model of the Spurgin belt shifter. Represented by R. G. Haskins and Ralph Sloan.

HAUCK MFG. CO., Brooklyn. Venturi high and low pressure furnace burners for open-hearth furnaces, annealing furnaces, case hardening furnaces, forging furnaces, crucible melting furnaces, muffle and retort furnaces, plate, angle and rod heating furnaces, core ovens, etc.; also portable burners for cupola lighting, mold drying, ladle heating, straightening, bending, pre-heating for welding, thawing, etc.; hand torches for drying and patching cores, tool dressing, tempering small tools, etc. Represented by Jules Escheman, Herbert Vogelsang, A. F. Schuman, F. A. Thomas, F. J. Schwenk and W. C. Elze.

HAYNES STELLITE CO., New York. Haynes Stellite tool bits and welded tools for turning, boring and planing; blades for milling cutters, boring bars and reamers; solid milling cutters, die casting machine parts, hot billet scrapers and various other products. Represented by A. B. Leonard and W. J. Lindner.

HEPPENSTALL FORGE & KNIFE CO., Pittsburgh. Forgings, shear knives, an impact testing machine and moving pictures. Represented by G. I. Allen, Cleveland; F. C. Moyer, Detroit; A. L. Wurster, Philadelphia; R. C. Rose, Milwaukee, Wis., and C. J. Sauer, Bridgeport, Conn.

HOLCROFT & CO., Detroit. Two electric melting furnaces, small size. Represented by H. L. Ritts, sales manager; R. T. Cadwell, secretary and treasurer; C. E. Chaney, electrical sales engineer; A. Ruckstahl, engineer; H. M. Gregory and F. E. Gardener, Canadian representatives.

HOSKINS MFG. CO., Detroit. An electric heat treating furnace, equipped with five alloy tubes, through which the material to be heat treated is shoved by an automatic pusher. This furnace is declared to be particularly adapted to the heat treatment of such parts as knuckle bolts, spring bolts, piston pins and similar small pieces. The principal feature of the outfit is that it allows individual quenching of each piece. Represented by J. D. Sterling, R. P. Ellis, W. D. Little, W. A. Gatward and C. S. Kinnison.

E. F. HOUGHTON & CO., Philadelphia. Cutting oils, carburizers, tempering and drawing oils, quenching oils, Houghton's absorbed oils and Vim leather belts and packings. Represented by H. G. Lloyd, G. W. Pressell, W. A. Buechner, D. J. Richards and C. H. Schultz.

HUNTER SAW & MACHINE CO., Pittsburgh. Inserted tooth and solid tooth circular milling saw blades; also hot saws, tube saws, inserted tooth saw grinders, sharpening and beveling machine for sharpening and beveling teeth of milling saw blades; also a line of hardened steel specialties such as circular shear knives, clutch disks, valve plates, core plates, brick mold liners, pneumatic hammer rivets, sets and chisel blanks. Represented by the entire staff of the company's heat treating department and officials of the sales department.

I

INTERNATIONAL NICKEL CO., New York. Various finished products made of nickel steel. Represented by P. D. Merica, C. McKnight, Jr., and L. Muller-Thym.

INTERSTATE IRON & STEEL CO., Chicago. Finished parts made from the company's steel as produced by the leading spring manufacturers of the United States; also assemblies and units of other motor car parts such as transmissions, in connection with a mill display of sections and samples indicating the scope and character of the company's alloy steel production; also a three reel film known as "The Story of Alloy Steel." Represented by Paul Llewellyn, vice-president; W. J. MacKenzie, metallurgist, and Elmer Larned, assistant.

J

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh. Specimens illustrating the different products this company manufactures. Booth fitted up as a reception room. Represented by Jesse J. Shuman, H. W. Graham and A. Milne.

K

KELLER MECHANICAL ENGRAVING CO., Brooklyn, N. Y. Keller heavy-duty automatic die-cutting machine, motor driven, with centrally located push-button controls, of a type designed to handle the largest dies for which hammers are built; shown cutting a 48-in. die for one of the leading manufacturers of the United States, on a Hardtem steel block, from a cement master; also a new device for finishing dies. Represented by Jules Dierckx, vice-president and sales manager; S. A. Keller, treasurer; Charles Bitter and A. J. Benson.

KING REFRACTORIES CO., Buffalo, N. Y. Flame brand cements for laying up, veneering and patching fire brick linings, monolithic walls and baffles, together with bulletin machines with slides of different installations of the company's materials. Represented by S. C. Smith, president; E. J. Eddy, treasurer, and H. J. Parthesius, Pittsburgh sales agent.

KINITE CO., Milwaukee, Wis. Kinite and Kompite castings and patterns from which these castings are made; also stamping made on Kinite and Kompite dies. Represented by T. A. Moorman, superintendent; H. F. Kluender, Detroit representative; William C. Eakin, Pittsburgh representative, and E. J. Mohr, sales manager.

CHARLES KLEIST & SON, Jamestown, N. Y. Built-up and standard type hammer boards and hammer pins. Represented by H. E. Kleist.

L

LAUGHLIN-BARNEY MACHINERY CO., Pittsburgh. Various machine tools, including a 32-in. Dreadnaught shaper made by the Ohio Machine Tool Co.; Nos. 2 and 4 Oliver drill pointers and by the Oliver Instrument Co.; drilling machines made by the Avey Drilling Machine Co.; gooseneck type broaching and assembling presses made by the Oilgear Co., and high-duty drilling machines made by the Foote-Burt Co. The Ohio Machine Tool Co. represented by C. C. Swift, secretary and treasurer; Oliver Instrument Co., represented by E. C. Oliver, president, and W. G. Shutt; Avey Drilling Machine Co., represented by J. G. Hey, vice-president and general manager; Oilgear Co., represented by W. D. Creider, sales manager; Laughlin-Barney Machinery Co., represented by Harry E. Barney, J. K. Henry, William Katzenmeyer, R. C. Neimeier, C. W. Pompey and J. M. Hill.

LEEDS & NORTHRUP CO., Philadelphia. Potentiometer pyrometers of the indicating, recording, signalling and controlling types, and equipment for heat treatment by the Hump method, this equipment in operation hardening carbon and alloy steel tools. Represented by G. W. Tall, Jr., A. E. Tarr, O. Brewer, H. Brewer and E. B. Estabrook.

E. LEITZ, INC., New York. Leitz micro-metallograph, a large metal microscope with camera; medium type microscope, model MO, workshop microscope, model MT, Brinell microscope, assortment of grinding and polishing machines, several models of mineralogical microscopes and assortment of accessories of interest to steel manufacturers. Represented by G. Spindler, in charge of company's technical department, and H. E. Bader, Middle West representative.

LUDLUM STEEL CO., Watervliet, N. Y. Special tools made from Ludlum steels, such as chisels, dies, punches, reamers, twist drills, etc.; also valves made from the company's Silcrome valve steel; also specimens of non-corrosive steels and high-speed tools. Represented by V. S. Yarnall, assistant to the president; W. H. Vrooman, assistant manager of sales; Charles B. Templeton, Jr.; also in attendance: T. C. Sherman, Cleveland manager; P. R. Thurston, Pittsburgh representative; J. E. Polhemus, Detroit manager; Harry I. Askew, Herman W. Spiegel and John J. Cruice, Detroit representatives; W. A. Edwards, Chicago manager; P. E. Floyd, Chicago representative.

M

MAHR MFG. CO., Minneapolis, Minn. Mahrvel standard heat treaters and tool furnaces, Mahrvel direct-connected blowers and kindred equipment. Represented by W. M. Horner, president; H. A. Anderson, chief engineer; B. G. Harmon, manager Chicago branch; E. F. Piea, Philadelphia representative; A. D. Fihsel, Cleveland representative; James A. Murrian, Knoxville, Tenn., representative, and H. R. Rosendahl, field engineer.

JAMES H. MATTHEWS & CO., Pittsburgh. Marking devices for the marking of metals, including steel stamping and embossing dies, steel letters and figures, brass and rubber dies for box printing, marking inks, identification checks and badges, metal shipping tags, bronze signs. Represented by Harry Ehrlen, J. L. McConaghy and H. R. Wade.

THE MIDVALE CO., Nicetown, Philadelphia. Hardened and ground rolls for cold rolling all sorts of metals; stainless steel exemplified by pieces of finished cutlery; also exhibits showing eight stages in the manufacture of revolver chambers; also models or patterns used in the Midvale shops for all sorts of rough and finished machining. Represented by Stuart Haslewood, vice-president; H. E. Rowe and J. E. De Cray, Philadelphia; W. B. Smyth and J. C. Glass, Cleveland.

MOLYBDENUM CORPORATION OF AMERICA, Pittsburgh. Samples of tungsten ore and ferro-tungsten, samples of molybdenite ore, molybdic acid, ferro-molybdenum, molybdenum metallic powder, molybdenum wire and sheet; also many products made from molybdenum steels, such as springs, chisels, shovels, rolling mill rolls, lock washers, bearings, etc. Represented by J. M. Fuller, in charge of exhibit, with attendance also by J. W. Weitzenkorn, vice-president and general manager; Clifton Taylor, general sales agent; E. A. Lucas, works manager.

MOTCH & MERRYWEATHER CO., Cleveland. Various machine tools sold by this company in the Ohio territory. Represented by salesmen of the company and special representatives of machine tool builders.

N

NATIONAL MACHINERY CO., Tiffin, Ohio. Display of samples of products produced on forging machines and bolt, nut, rivet and wire nail machinery made by this company. Represented by Charles Harmon, K. L. Ernst and F. J. Mawby.

R. D. NUTTALL CO., Pittsburgh. A display of miscellaneous small gears which have been hardened by the company's special process; also flexible couplings and the assembly power unit through courtesy of the Denver Rock Drill Co. Represented by W. H. Phillips, chief engineer; R. W. Young, sales engineer; L. H. Keim, engineer; W. H. Smith, sales engineer, with the following officials of the company also in attendance: Milton Rupert vice-president; Q. W. Hershey, sales manager; C. H. Doolin, sales engineer; L. F. Burnham, engineer; J. A. Bouslough, assistant works manager; E. C. Wilson, railway sales department; C. H. Parker, industrial sales department; Miss H. Gatens, mining sales department.

O

S. OBERMAYER CO., Pittsburgh. Various high temperature furnace cements and the company's special prepared charcoal for loose-pack rolling. Represented by E. D. Frohman, J. L. Cummings, F. A. Eggert, W. C. Samuels and F. P. Bullion

OHIO MACHINE TOOL CO. An Ohio 32-in. Dreadnaught shaper, with four-speed selective-type gear box, all gears of heat-treated alloy steel. Represented by John Leibold and C. C. Swift.

OLIVER INSTRUMENT CO., Adrian, Mich. Two sizes of the company's automatic drill grinders and one of its filing machines. Represented by E. C. Oliver and W. G. Schutt.

TINIUS OLSEN TESTING MACHINE CO., Philadelphia. Completely equipped laboratory, comprising some of the newest testing machines and instruments, such as universal testing machines for tension, compression and transverse testing of wire and other material, also fitted with special attachments for Brinell hardness tests, ductility tests for sheet metal, also for testing welds and welding material by the Owens method, also for testing valves, fitting and gages hydro-statistically; various types of Olsen hydraulic Brinell hardness testers, the Olsen hardness testers for sheet metal, Olsen ductility testers for sheet metal; also repeated impact testing machines of the Matsumura type, special spring testing machines, the Olsen-Boyd cement tester, the latest machine of its type, and elasicity testing machines for wire. The Olsen-Williams dynamic ductility testing machine, which is the recording type, and the Herbert pendulum hardness tester are special features, the latter being shown in this country for the first time.

P

PANGBORN CORPORATION, Hagerstown, Md. Barrel sand-blast, cabinet sand-blast and rotary table sand-blast equipment, all in operation demonstrating the sand-blasting of heat treated parts, forgings, etc.; also a display of photographs showing sand-blast equipment installations in heat treating plants, interesting specimens of the heat-treating art and a complete display of metallic abrasives. Represented by John C. Pangborn, vice-president; F. E. Wolf, district sales engineer, and H. D. Gates, sales manager.

PANNIER BROTHERS STAMP CO., Pittsburgh. Devices employed for marking of steel, employing steel stamps and dies; also a duplicate of the first mechanical device employed for making a mark, which is said to date back to the Runic period, the original of which is in the Husaby Museum in Sweden. Represented by O. M. Pannier, president; W. J. Pannier, Jr., vice-president; F. Speicher, Jr., W. W. Hague and C. C. Gray.

PARK CHEMICAL CO., Detroit. Case hardening compounds, Cyanides, cyanide mixtures, reheating materials, lead pot carbon, quenching and drawing oils and furnace cements. Represented by Messrs. Schermer and Bourg.

PEERLESS MACHINE CO., Racine, Wis. One 6 x 6-in. universal shaping saw, one 13 x 13-in. universal shaping saw and one 9 x 9-in. high-speed hack saw, all in operation. Represented by H. J. Swanson, general sales manager; A. H. Goetz, Pittsburgh representative, and R. W. Hansen, Cleveland representative.

PENNSYLVANIA PUMP & COMPRESSOR CO., Easton, Pa. Pennsylvania air compressor in operation, furnishing air for the use of other exhibitors, and therefore working under normal conditions. Represented by George C. Towle, Pittsburgh representative, and R. H. Mellick and Charles A. Benckert, from the company's shop.

PITTSBURGH INSTRUMENT & MACHINE CO., Pittsburgh. Brinell testing machine, impact testing machine, sheet metal tester and metallographic grinding machine. Represented by Paul Kammerer and Charles Trueg.

Q

QUIGLEY FURNACE SPECIALTIES CO., New York. High temperature insulation in brick block, powder and cement form for retarding heat flow through furnace walls and other heated equipment; Hytempite, a high temperature cement for bonding fire brick and other refractories, its bonding qualities being demonstrated by electric furnace tests under severe temperature changes. Represented by W. S. Quigley, president; W. H. Gaylord, Jr., traveling sales manger, and D. F. McMahon.

R

RACINE TOOL & MACHINE CO., Racine, Wis. Racine high-speed metal cutting machines, including the No. 5 machine of 6-in. capacity, motor driven through silent chain drive; also a Racine duplex band saw, the latest addition to the company's line; also Racine Junior 4-in. machine, which is a portable metal-cutting machine for the average small shop.

RODMAN CHEMICAL CO., Verona, Pa. Case hardening or carburizing compounds, luting or sealing compounds, quenching oils and tempering oils. Represented by Hugh Rodman, general manager, and Gordon A. Webb, Detroit district manager.

ROESSLER & HASSLACHER CHEMICAL CO., New York. Chemicals for case hardening such as sodium cyanide, copper cyanide, sodium prussiate, potassium prussiate, etc., and case-hardened metal parts, including gears and pinions. Represented by Charles H. Proctor, William M. Gager and a representative from the company's Pittsburgh office.

F. J. RYAN & CO., Philadelphia. Different types of burners, including new automatic combination gas and oil burner; also working models of firm's new automatic temperature control for gas and oil burners; a small working model of new type of resistor hanger block for electric furnace construction. Represented by F. J. Ryan, president; G. F. Beach, chief engineer; F. A. Hall, sales department; J. L. Edwards, Pittsburgh manager, and Harry M. Austin.

S

SCIENTIFIC MATERIALS CO., Pittsburgh. Various machines used in heat treating operations, such as the Brinell hardness testing machine; the F. & F. optical pyrometer, a direct reading pyrometer for measuring pouring, heat treating and other temperatures; the S. M. Co. optical bench for the examination and photography of microstructure of metals; grinding and polishing machines for preparing specimens for micro-examination; levigated alumina, a special prepared solution for metallographic polishing. Represented by E. H. Fisher, E. C. Mateja and E. P. Dillinger.

SHORE INSTRUMENT & MFG. CO., Jamaica, N. Y. Testing devices, including recording scleroscope, model D, and improved vertical scale scleroscope, model C-1, both of which are used for measuring the hardness of metals; Pyroscope, for measuring high temperatures; Durometer, for measuring hardness of rubber; Eastometer, for measuring elasticity of rubber; Localcase, for selective case hardening; Localhard, for selective tool steel hardening. Represented by F. G. Kendall.

SPENCER TURBINE CO., Hartford, Conn. Turbo compressors for supplying air in connection with oil and gas-burning industrial furnaces, foundry cupolas, etc. Represented by H. M. Grossman, sales engineer, and O. J. Dingee, engineer.

STEEL CITY TESTING LABORATORY, Pittsburgh. Hand and power operated Brinell machines for various loads. Represented by H. A. Weaver, general manager.

SURFACE COMBUSTION CO., New York. A combination gas and oil burner equipped with automatic proportioning devices; also a valve control common to all products of this company; also exhibits of the fundamental features of Surface combustion, such as inspirators, commonly called "gas carburetors," and the several types of gas burners which are used. Represented by F. J. Winder, manager of Pittsburgh office; M. Goodman and A. M. Apmann.

T

TACONY STEEL CO., Philadelphia. Bar steel, billets, forgings, die blocks and piston rods. Represented by H. A. Baxter, general manager of sales, and C. W. Forcier, Pittsburgh district manager.

TATE-JONES & CO., INC., Pittsburgh. Automatic control units for oil and gas, various types of burners; literature and information relating to electric furnace operation. Represented by Edward Busch, Detroit; W. H. Busch, Dayton, Ohio; R. L. Mann, Buffalo, N. Y.; W. M. Smith, New York; P. J. Myall, and J. L. Stroman, Chicago.

TAYLOR INSTRUMENT COMPANIES, Rochester, N. Y. Full line of indicating and recording pyrometers; portable and wall type switchboard protection cases; also full line of heavy-duty thermo-couples; temperature regulators, central recorders and thermometers for brine, lead and oil tempering baths. Represented by G. A. Howell, Rochester, N. Y.; E. C. Taylor and Avery Taylor, Pittsburgh.

U

UNITED ALLOY STEEL CORPORATION, Canton, Ohio. Exhibition of charts and other data giving physical properties which may be received from various heat-treated alloy steels; also sections of forgings to show the proper grain flow. Represented by H. H. Pleasance, vice-president; M. F. McOmber, district sales agent, and F. W. Krebs, sales engineer.

UNION ELECTRIC STEEL CORPORATION, Carnegie, Pa. Die blocks, trimmer steels, piston rods and shoes. Represented by W. L. Goodrich, sales manager; R. J. Emery, I. J. Johnson, D. Stuart and W. H. Reeger.

U. S. CHAIN & FORGE CO., Pittsburgh. Specimens of various kinds of heat-treated chain; also moving pictures of the comparative wearing qualities of heat-treated and untreated chain. Represented by Frank L. Campbell, Frank A. Bond and William H. Reids.

V

V & O PRESS CO., Hudson, N. Y. A V & O double-length slide press, a model clutch, samples of recent developments in pressed metal working, miscellaneous dies, a dis-assembled V & O press and various photographs. Represented by Edward Cairns and R. O. Brunst.

VANADIUM-ALLOYS STEEL CO., Latrobe, Pa. Tools made from various grades of steels made by the company; fractures showing the result of different kinds of heat treatment of each grade of steel, and fractures showing the effect of different methods of manufacturing different grades of tool steel. Represented by J. P. Gill and L. D. Bowman, metallurgists; E. L. Moberg, vice-president in charge of operations, and the following sales representatives; A. F. Chilcott, Buffalo; W. R. Mau, A. G. Henry, R. F. Noonan, W. L. Coller, Chicago; F. W. Potts, Cincinnati; J. H. Caler, R. L. Daull, T. J. Van de Motter, Cleveland; J. S. Cole, Dayton, Ohio; A. F. MacFarland and D. D. Dodd, Detroit; D. A. Black, E. B. Kitfield, L. G. Murray, New England division; J. A. McKay, New York; A. W. Stephenson and F. C. Comas, Philadelphia; H. P. Edison, R. R. Artz, D. L. Bardes, Pittsburgh.

VANADIUM CORPORATION OF AMERICA, New York. Specimens of vanadium ore and ferrovanadium; Attractoscope exhibition of lantern slides of Peruvian scenes, mining and shipping vanadium ore and applications of vanadium steel. Represented by George L. Norris, in charge; Col. Merrill G. Baker, vice-president; B. D. Saklatwalla, Charles F. Fritz, J. A. Miller, Jr., H. T. Chandler and W. R. Flannery.

VULCAN CRUCIBLE STEEL CO., Aliquippa, Pa. Tool steels (high speed, alloy and carbon) and special steels, materials used in their manufacture and tools and parts made therefrom. Represented by G. L. Kronfeld and A. D. Beeken, Jr.

W

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh. A number of electric furnaces of the muffle and wire-wound type, round and rectangular crucible furnaces, tube furnaces and combustion furnaces, also oven heaters, air heaters and space heaters; a furnace and an oven in operation heat treating steel and an electrically heated oil bath. Represented by W. S. Scott, manager of industrial heating section of the industrial sales department, and members of the sales and engineering departments.

WILSON-MAEULEN CO., New York. Indicating and autographic thermoelectric pyrometers and electrical resistance thermometers; also three sizes of Rockwell direct-reading hardness tester. Represented by S. C. Horn, Pittsburgh; C. E. Hellenberg, Detroit, and Harvey Lee, Cincinnati.

WITHEROW STEEL CO., Pittsburgh. Continuous die-rolled products such as ring gear blanks, front axle blanks and rear axle shafts. Represented by W. P. Witherow, president; J. S. Langston, general sales manager, and Lee Leibinger, sales engineer.

WARNER & SWASEY CO., Cleveland. No. 3-A universal hollow hexagon turret lathe in operation, doing both bar and chucking work. Represented by C. J. Stilwell, domestic sales manager; A. H. Keetch, manager Buffalo office; J. E. Figner, Pittsburgh representative, and Frank Castle, demonstrator.

Technical Program for the Convention

The program of technical papers, round table discussions and symposiums for the fifth annual convention of the American Society for Steel Treating at Pittsburgh, Oct. 8 to 12, is as follows:

Note: Registration begins at 1 p.m. at Registration Desk, Motor Square Garden.

MONDAY, OCT. 8

10: a.m.—Meeting in Ball Room, William Penn Hotel.
Chairman .....W. J. Merten
Address of Welcome.....J. Trautman, Jr.
Welcome to Pittsburgh.....Mayor Wm. Magee
Response .....Pres. T. D. Lynch

"The Manufacture of Automobile Leaf Springs," by C. G. Shontz, metallurgist, Perfection Spring Co., Cleveland.

"Metallography and Testing of Oxyacetylene Welds," by J. R. Dawson, research metallurgist, Union Carbide & Carbon Research Laboratories, Inc., Long Island City, N. Y.

"Some Observations on Furnaces and Fuels, Including the Electric Furnace for Heat Treating," by E. F. Collins, consulting engineer, General Electric Co., Schenectady, N. Y.

"The Tempering of Tool Steels," by J. P. Gill and L. D. Bowman, metallurgist, Vanadium Alloys Steel Co., Latrobe, Pa.

"Abnormal Grain Growth in Cold Rolled Low Carbon Steel," by V. E. Hillman and F. L. Coonan, metallurgist and assistant metallurgist, Crompton & Knowles Loom Works, Worcester, Mass. (To be presented by title.)

1:00 p.m.—Exposition opens.

3:30 p.m.—Technical Session—Motor Square Garden.

"The Annealing of Sheet Steel," by Francis G. White, Metallurgical engineer, National Enameling & Stamping Co., Granite City, Ill.

"Sheet Steel for Automotive Purpose," by Harry Martin, metallurgical department, Dodge Bros., Detroit.

"The Manufacture of Sheet Steel," by J. H. Nead, research metallurgist, American Rolling Mills Co., Middletown, Ohio.

"Automobile Sheet Steel Specifications," by H. M. Williams, metallurgist, General Motors Research Corporation, Dayton, Ohio.

7:00 p.m.—Moving Pictures—Exposition open until 10 p.m.

TUESDAY, OCT. 9

9:30 a.m.—Meeting in Ball Room, William Penn Hotel.

"Measurement of Carbon Penetration in Carburized Steels," by S. P. Rockwell, consulting metallurgist, Hartford, Conn., and Frederick Downs, chemist, New Britain Machine Co., New Britain, Conn.

"Case Hardening and Other Heat Treatments as Applied to Gray Cast Iron," by H. B. Knowlton, inspector, Central Continuation School, Milwaukee, Wis.

"The Influence of Barium Carbonate upon Wood Charcoal used for Cementation," by B. F. Shepherd, metallurgical department, Ingersoll-Rand Co., Phillipsburg, N. J.

"Protective Coatings for Selective Carburization," by J. S. Vanick and H. K. Herschman, metallurgist and assistant physicist, Bureau of Standards, Washington.

Investigation of the Treatment of Steel for Permanent Magnets," by R. L. Dowdell, instructor in metallography, University of Minnesota, Minneapolis, Minn.

"The Thermal Treatment of the Light Alloys of Aluminum and Copper," by A. M. Portevin and Francois Le-Chatelier, Paris, France. (To be presented by title).

12:10 p.m.—Plant Vistation, Westinghouse Electric & Mfg. Co.

1:00 p.m.—Exposition opens.

3:30 p.m.—Round Table Discussion under Direction of Standards Committee, Motor Square Garden; Chairman, R. M. Bird.

Exposition open until 10 p.m.

7:00 p.m.—Moving pictures.

9:30 p.m.—Annual Smoker and Entertainment, Ball Room, William Penn Hotel.

WEDNESDAY, OCT. 10.

9:30 a.m.—Annual Meeting of the Society, Ball Room, William Penn Hotel; Chairman, T. D. Lynch.
Report of Tellers of Election.....C. G. Shontz
President's Address.....T. D. Lynch
Report of Treasurer.....J. V. Emmons
Report of Secretary.....W. H. Eisenman
Report of National Committees
Standards .....R. M. Bird
Constitutions and By-Laws.....S. M. Havens
Report of Chaper Delegates.

1:00 p.m.—Exposition opens.

2:00 p.m.—Plant Visitation, Homestead Works, Carnegie Steel Company.

3:30 p.m.—Round Table Discussion and Technical Session on Forgings, Motor Square Garden.

"The Manufacture of Heavy Forgings," by W. R. Klinkict, foreman, Heat Treating Department, Pollak Steel Co., Cincinnati.

"Determining Heat Treating Costs," by H. F. Wood, metallurgist, Wyman-Gordon Co., Ingalls-Shepard Division, Harvey, Ill.

"Spark Testing of Steel," by Don Stacks, consulting metallurgical engineer, Hartford, Conn.

"Some Fundamental Defects of Hardened Steel," by Dr. Leslie Aitchison, Birmingham, England. (To be presented by title).

7:00 p.m.—Moving pictures.

9:30 p.m.—Informal Dance, Ball Room, William Penn Hotel. Exposition open until 10:00 p.m.

THURSDAY, OCT. 11

Exposition opens at 10:00 a.m.

9:30 a.m.—Technical Session, Ball Room, William Penn Hotel; Chairman, H. M. Boylston.

"Effect of Heat Treatment on Lathe Tool Performance and Some Other Properties of High-Speed Steels," by H. J. French, physicist, Bureau of Standards, Washington; Jerome Strauss, materials engineer, U. S. Naval Gun Factory, Washington, and T. G. Digges, assistant physicist, Bureau of Standards, Washington.

"Secondary Hardness in Austenitized High Chromium Steels," by E. C. Bain, research metallurgist, Atlas Steel Corporation, Dunkirk, N. Y.

"The Hardening of Steel," by Zay Jeffries and R. S. Archer, research bureau, Aluminum Co. of America, Cleveland.

"Crystallization of Iron and Its Alloys," by Albert Sauveur, professor of metallurgy, Harvard University, Cambridge, Mass.

"X-Ray Examinations of Steel Castings," by F. C. Langenberg, metallurgist, Watertown Arsenal, Watertown, Mass.

2:30 p.m.—Technical Session, Motor Square Garden, Hardness Testing Symposium, National Research Council, Maj. A. E. Bellis, Chairman.

"The Hardness of Common High Sheet Brass," by A. L. Davis, metallurgist, Scovill Mfg. Co., Waterbury, Conn.

"Magnetic Indications of Hardness and Brittleness," by A. V. deForest, research department, American Chain Co., Bridgeport, Conn.

"Testing of Steel for Hardness," by H. M. German, Metallurgist, Henry Disston & Sons, Inc., Philadelphia.

5:30 p.m.—Exposition closes.

6:30 p.m.—Annual Banquet of the American Society for Steel Treating, English Room, Fort Pitt Hotel. Tickets at Registration Desk.

FRIDAY, OCT. 12

Exposition opens at 10:00 a.m.

9:30 a.m.—Technical Session, Ball Room, William Penn Hotel; Chairman, Paul D. Mercia.

"Salt Baths and Containers," by Sam Tour, Metallurgist, Doehler Die Castings Company, Brooklyn, N. Y.

"The Physical Properties of Metals at Elevated Temperatures," by Vincent T. Malcolm, metallurgist, Chapman Valve Mfg. Co., Indian Orchard, Mass.

"The Ageing of Steel," by W. P. Wood, department of metallurgy, University of Michigan, Ann Arbor, Mich.

"Conical Illumination in Metallography," by H. S. George, Union Carbide & Carbon Research Laboratories, Inc., Long Island, City, N. Y.

"Carbon and Carbon—Vanadium Steel Castings—A Comparison," by J. M. Lessells, metallurgist engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh.

"The Theory of Quenching in Steels," by Kotaro Honda, Tohoku Imperial University, Sendai, Japan. (To be presented by title).

12:00 m.—Plant Visitation, National Tube Works, McKeesport, Pa.

2:30 p.m.—Motor Square Garden.

Symposium on Metallurgical Education; Chairman, Prof. S. L. Goodale.

7:00 p.m.—Band Concert.

10:00 p.m.—Exposition Officially Closes.

Methods of Testing Iron Castings*

Developments in American Practice—What an International Arbitration Bar Should Be in Respect to Shape, Length and Diameter

BY DR. RICHARD MOLDENKE

[In the early part of the paper the author tells why the testing of castings themselves is generally impracticable and refers to the experience with test coupons, passing to the evolution of the separately cast test bar. Stress is put upon the fundamental idea which always must be kept in mind—that test bars do not represent the castings made of the same iron, but only the quality of the iron going into these castings. The hope is expressed that eventually foundrymen will be spared the molding up of coupon test bars, which in addition to being highly troublesome are made under technically unreliable conditions.—EDITOR.]

As the separately cast test bars, representing the quality of the iron poured into the castings of the same cupola or furnace melt, began to come into general use—eventually for the foundryman as much as for his customers—the cumbersome lengths [originally as much as 5 ft.] were reduced to test at 3 ft., then 2 ft., as still used today in the standard cast iron pipe test bars; and finally down to the present American bar which is placed upon supports 1 ft. apart and broken transversely. Tensile test pieces were always made short and saw an evolution from square, flat or round pieces of about 1 ft. in length and gripped by the flat wedges of the testing machine, to the present day carefully turned test pieces made from the broken halves of the arbitration bar and provided with finely threaded ends, so that alignment in the testing machine may be as nearly perfect as possible before and during test.

In the early test bar days a variety of shapes were used. The square bar predominated, usually 1 in. square in section, though for years the ½-in. square section held its vogue in the light castings shops. The round bar of today for transverse testing was practically unknown at first, and came into use after many series of tests had been made by early investigators.

The American Tests of 1898-1900

This change and simplification of the test bar situation was concomitant with the advance in knowledge of the physical and chemical properties of cast iron, and as this information grew in extent more or less elaborate investigations into the subject were instituted by foundry and engineering bodies the world over. These led to the publication of the results of many testing programs. The most complete of these ever made, and the last conducted in the United States (in 1898-1900), was that of the American Foundrymen's Association, the writer of this report being chairman of the committee having the matter in charge. The tests involved the pouring of tons of bars of many kinds of iron under the very best of foundry conditions. The results were studied by committees of the American Foundrymen's Associations and the American Society for Testing Materials jointly, and formed the basis of the specifications now in use. The leading foundrymen and metallurgists of the United States were members of these committees, and they disregarded customs where these conflicted and evolved definite lines of procedure which are still standard today, and are used where buyer and seller clash in specification contracts.

Use of the Arbitration Bar

Be it understood that the American standard arbitration test bar never has replaced and never will replace the test bars used by individual foundries that are loath to change their old ways. But for universal comparison of results it is essential that a standard be adopted with which all other bars can be correlated by suitable factors. A national standard may even consist of several bars of different cross-sections to care for an extended silicon range and thus cover a wider field in lines of castings than a single bar. But when it comes to an international standard, it would seem essential that but one bar be selected which would cover the metal going into castings used for machinery and pieces of construction rather than to include such special work as chilled rolls, crusher parts, or the very lightest and thinnest castings in which strength is not essential.

The American arbitration test bar, as well as the method of preparing and testing it, as first advanced by the two societies above mentioned in 1905, has proved satisfactory to the present day in every respect but its length. When first advanced, the method was ahead of the times. The foundry industry, however, has slowly worked up to it, and the arbitration bar is specified for general as well as specific lines of castings to judge the quality of the metal going into the product.

Americans Receptive to a New Bar

The American foundrymen and engineers are now ready to consider the lengthening of the bar and possibly increasing the diameter somewhat at the same time. They will be glad, however, to await international action on this point, so that when an international arbitration test bar is adopted this may possibly be as acceptable as the American national bar.

That the reasoning by which the present American test bar was worked out may be fully understood, a summary of the arguments used is given in what follows:

First, the section of the bar. The cast iron pipe industry announced at the outset that it would retain its standard test bar. It is the same bar as used in Great Britain, namely, 2 in. x 1 in. in section and 26 in. long. It is tested on supports 24 in. apart. The bar is placed flat in American, and on edge in British testing. This bar has the advantage of approaching the general distribution of metal in cast iron pipe. It is long and exhibits elasticity under test. The disadvantage of the bar is the fact that it has four hard edges, as in square bars, so that when put under transverse center loading with maximum strain on the outer fiber of the metal, this is soft in the middle and hard at the ends. Such a bar sliced longitudinally into three sections of equal width will show widely different metal in middle and end pieces. It is to be hoped that when an international standard bar is agreed upon, this will be long and flexible enough to replace the antiquated flat cast iron pipe bar which does not effectively register serious differences in chemical composition or different pig-scrap relations for equal compositions.

Square Bars and Round Bars

The disadvantages with the flat section are those of the square section. On comparison of test results of square bars with round ones of equal sectional area, the former will always be found stronger. This because of the greater proportion of combined carbon, the four edges cooling more rapidly than the balance of the metal. The metal in a square bar is, therefore, not under as natural a condition of setting and cooling as in a round one, and consequently the round section was determined upon as a matter of basic principle in the American standard. In fact, it might be stated

*From a paper read at the International Foundrymen's Convention, Paris, France, Sept. 15, 1923.

that about the only advantage a square bar has is that it rests better upon the test supports, and the outer fiber of the metal tears along a line rather than at a point.

The disadvantages of the round bar are the concentration of the maximum fiber stress on the lower point of the fracture circle, and the inconvenience of the test piece for transverse testing. The decisive advantage of the round section bar, however, is the uniform change in the character of the metal from the center of the bar to every point on the periphery of the fracture circle.

At the time of the adoption of the American standard arbitration bar practically every one in America who made bars at all—outside of the cast iron pipe interests—used a length which allowed a tranverse breaking test on supports 12 in. apart. The bars, therefore, varied from 13 in. to 15 in. in length. The question of studying the deflections had not then assumed any particular importance, as the stronger irons made with steel additions to the mixtures had only made their appearance sporadically. With the general use of steel scrap in mixtures, giving a line of castings going under the misnomer "semi-steel," however, the measure of the resilience of cast iron became of interest, and there is a desire manifest for a longer bar which would exhibit deflections that can be differentiated and would mean something.

The length of an international bar will probably be a matter of compromise, as nations using short bars will yield on some increase, just as nations using very long bars will agree to a shortening. The International Association for Testing Materials had proposed an international test bar with dimensions which would be readily convertible in English and Metric measurements. It was to be tested on supports 18 in. or 45 cm. apart. The bar itself was to be at least 20 in. or 50 cm. long, to be safe in case of short pouring the mold. From the reports of testing bodies of the more interested nations, this bar length seems generally acceptable, and it is suggested as a basis for discussion when this matter of an international test bar is taken up seriously for settlement.

The question of the test bar diameter is a matter that may require some further study on the part of the interested foundrymen and engineers of the world. The bar originally proposed was to be 1.2 in. or 30 mm. in diameter. Many of us have made numerous tests with a bar of this diameter, broken on supports 18 in. apart. The curves obtained from these transverse tests on irons of a variety of compositions are not altogether satisfactory and indicate that the bar is too flexible for its length. Might it not be well to agree first upon the shape of the cross-section and the length of the bar as broken upon supports for test, and then make a study of the desirable diameter of such a bar, so that a proper degree of sensitiveness may be attained for deflection as well as for load. This thought is advanced for the reason that all the other points involved in the selection of an international bar should lend themselves to a ready adjustment, whereas the most advantageous diameter or section for a bar to be broken on supports 18 in. apart has not yet been evolved by systematic study.

Non-Ferrous Metals in Engineering

Arsenic in Firebox Copper—Copper-Tin and Copper-Zinc Alloys—Bearing Metals—Future of Aluminum

LONDON, ENGLAND, Sept. 10.—The autumn meeting of the Institute of Metals, which is being held in Manchester during the present week, exemplifies the great difficulty experienced by the Council in obtaining papers on practical subjects to lay before its members. Partly for this reason, the announcement that Sir Henry Fowler had consented to deliver the "tumn" lecture, and that his subject would be "Non-Ferrous Metals in Engineering," aroused considerable interest. Sir Henry is one of the best-known locomotive engineers in this country, and, as a very large purchaser of metals, his observations were listened to with close attention by a large body of metallurgists. He touched only upon certain phases of the subject and he confined himself principally to copper and its alloys, white metals, aluminum and its light alloys and one or two non-ferrous alloys which are of especial interest to engineers.

Sir Henry reiterated his faith in copper for locomotive fire boxes—a matter about which there is practical unanimity of opinion among British locomotive engineers. He challenged the view expressed by E. F. Law in his "Alloys and Their Industrial Uses," that "it is no uncommon thing to see the surface of the copper plate showing drops of copper where the metal has been actually melted," and a personal examination of hundreds of locomotive fire boxes failed to prove this, although the metal is on the surface subjected to a great heat.

Value of Arsenic in Firebox Copper

The troubles which lead to the removal of the plates of a locomotive fire box are, according to Sir Henry Fowler, the wear at the sides and the cracking where bending has taken place, and in certain cases round the stud holes. The wear is probably due to combined effects of erosion and oxidation, and has been diminished by adding from 0.35 to 0.50 per cent of arsenic to the copper. If the oxygen in a copper containing this amount of arsenic exceeds 0.15 per cent, the metal is liable to give trouble in the bending essential in manufacture. The copper stay which joins the inner copper to the outer steel plate of the fire box is regarded as a greater source of trouble than the copper plate, and Sir Henry deplored the gradual disappearance of the riveted head on the fire side. The "wear" of the head, however, like that of the plate, seems to be the joint effects of erosion of the particles of fuel and oxidation. When, however, the end of a stay which has been worn down is examined no sign of oxidation is found.

Behavior of Copper-Tin Alloys

Turning to the heat treatment of copper-tin alloys the lecturer said there is only a slight effect at quenching after raising to less than 500 deg. C. At a temperature above this, however, although a higher tenacity and elongation may be obtained, the softer homogeneous structure which results may be unable to resist wear. The following instances, although widely different, will illustrate this point.

Some years ago, at Derby, a careful investigation was carried out on the subject of the composition of the slide valves used in the Midland Railway Co.'s locomotives. The alloy was copper 85, tin 14, lead 1 per cent, and it was found that these valves when subjected to a tensile test broke easily. When, however, the valves were raised above 500 deg. C. and quenched they were found to be extremely tough. As a result arrangements were made to deal with all the valves in this way, but before they could be completed it was found that the homogeneous metal that resulted wore so badly that the old method of using a sand cast was reverted to, with satisfactory results.

The second case runs on different lines. When the war broke out there was at once a great demand for certain vehicles in which the steel axles ran in a phosphor-bronze pipe box, the composition of which was copper 88, tin 11 and phosphorus 1 per cent. The metal satisfied the mechanical tests, but was so hard that it was impossible to fulfill the promises of machining. A method of heat-treatment was devised that not only

gave a metal which satisfied the mechanical tests, but was machined in just one-third of the time that the original metal took.

Copper-Zinc Alloys

Sir Henry Fowler next passed on to the question of brasses, or copper-zinc alloys, the use of which in engineering may be divided into castings, stampings (hot-pressed) and pressings and spinnings (worked cold). In the majority of cases what is required by engineers from a brass casting is not strength, but to act as a vessel—such as an oil cup—certain portions lending themselves to easy machining. A brass with up to 2 per cent of lead does this perfectly.

For the so-called manganese-bronze (the name is not a correct one, for it is in reality a brass with copper from 55-60, zinc from 35-40 per cent; under 1 per cent manganese, and with small percentages of tin, lead, iron and aluminum) Sir Henry Fowler predicts an even greater future. It was used extensively for ordnance parts, although care has to be taken in casting, as a large head and runners are essential. It has been found most useful for axle-boxes which are liable to be hammered, as its properties are such as to resist breaking from this cause. It is, however, soft, and must not be subjected to abrasion.

Phosphorus and Solid Castings

Discussing the influence of phosphorus, Sir Henry pointed to the great advantage of introducing it easily into an alloy either as phosphor-copper or phosphor-tin. Its reputation for giving sound solid castings is well and truly earned, for it frees the alloy from the oxides which cause trouble, and carries them with itself as phosphates into the slag. If a still further amount than that necessary to do this is added it forms a phosphide of copper, which forms hard wear-resisting particles in a soft matrix. The wearing properties will be proportional to the amount of this phosphide present, but it will be appreciated that the alloy hardens also as the percentage rises. This gives one a choice depending on the purpose for which the alloy is required.

Bearing Metals

Dealing with bearing metals, usually consisting of tin-antimony-copper-lead alloys, Sir Henry Fowler asked why we required more than one bearing metal. The answer is because, if the matrix or fixing is lead, it will be too soft to prevent, with heavy loads and repetition stresses, the crystals of tin-antimony being hammered into the matrix and the bearing-metal spreading. In such cases a harder matrix is required, and this may be supplied by using a higher percentage of tin and some copper, which, in its turn, forms tin crystals. For railroad bearings, the following three white metals have been adopted as temporary standards.

	Tin, Per Cent	Antimony, Per Cent	Copper, Per Cent	Lead, Per Cent	Brinell Hardness (500 Kilos)
No. 1.....	85	10	5	..	33
No. 2.....	60	10	2	28	20
No. 3.....	12	13	..	75	19

The first two will deal with all cases of bearings subjected to hammering or repetition stresses, while the lead base will deal with more lightly loaded bearings in which the journal or shaft only rotates.

Casting under conditions which lead to slow cooling encourages the growth of the tin-antimony crystals, while too rapid cooling will prevent their regular formation. With the 85 tin, 10 antimony, 5 per cent copper alloy good temperatures vary between 375 deg. C. as a minimum and 400 deg. C. as a maximum, taken at the time of casting, the bearing in which the metal is run being about 200 deg. C. The difficulty of impurities is a purely practical one, and one which is likely to occur in shops which, like locomotive shops, are largely engaged on repairs. From 1.5 to 2 per cent lead causes trouble in a tin-antimony-copper alloy, due to its tending to drag and break when the lubrication is not absolutely perfect. The Midland Railway Co. uses a mixture of 83 copper, 9 tin and 8 per cent lead with every satisfaction for locomotive axle bearings where the pressure and speed are not great. In these cases the lead does not alloy with the copper-tin, but remains as globules or threads. Some railroad companies are using high zinc bearing metals with success.

Sir Henry Fowler considered that engineers should keep in touch with research into the problems of non-ferrous metals, the results of which are extremely useful in practical application. This is notably so in regard to aluminum, which, itself is not a sound engineering proposition. Too much was expected of it in the early days, and we are now suffering the results of that disappointment. But, said Sir Henry, aluminum alloys are undoubtedly going to be used by engineers more and more as time goes on.

Bookings of Steel Castings

WASHINGTON, Sept. 22.—The Department of Commerce announces that August bookings of steel castings, based on reports from principal manufacturers, representing over two-thirds of the commercial-castings capacity of the United States amounted to 50,515 tons, as against 52,066 tons in July. The following table shows the bookings of commercial steel castings for the past eight months by 65 identical companies, with a monthly capacity of 96,900 tons, of which 38,300 tons are usually devoted to railroad specialties and 58,600 tons to miscellaneous castings.

	Total		Railway Specialties		Miscellaneous Castings	
Month	Net Tons	Per Cent of Capacity	Net Tons	Per Cent of Capacity	Net Tons	Per Cent of Capacity
January, 1923.	100,605	103.8	47,879	125.0	52,726	90.0
February	90,152	93.0	39,845	104.0	50,307	85.8
March	143,564	148.2	76,409	199.5	67,155	114.6
April	90,968	93.9	39,610	103.4	51,358	87.6
May	89,493	92.4	38,788	101.3	50,705	86.5
June	84,878	87.6	42,773	111.7	42,105	71.9
July*	52,066	53.7	16,741	43.7	35,325	60.3
August	50,515	52.1	18,332	47.9	32,183	54.9

*Two companies with a capacity of 785 tons per month on miscellaneous castings now out of business.

Valley Rolling Mills, Inc., Takes Over Merchant Bar Mill

The Valley Rolling Mills, Inc., Elmira, N. Y., recently incorporated under New York laws with $750,000 capital to take over a complete merchant bar and light structural shape mill, originally built by the Quirke interests, will begin rolling at once on bars and bands, particularly in the small sizes. Marcel K. Sessler of New York has joined the organization as vice-president and treasurer, and will be actively associated in executive matters with E. F. Quirke and J. S. Quirke, both experienced, practical mill men, and will be in charge of the production end of the business. The company expects to stress its ability to make light weights, which are often difficult to obtain, and to give service both as regards quick delivery and in meeting special requirements. The general negotiations and this consolidation were effected through the Engineering Business Exchange, 30 Church Street, New York, of which Charles Whiting Baker, formerly editor of the *Engineering-News Record*, is the director.

Lackawanna Plate Mill to Have Electric Drive

The Bethlehem Steel Co. has ordered from the Westinghouse Electric & Mfg. Co. electrical equipment to replace a steam drive for a 30 x 48-in. universal plate mill in its Lackawanna plant, Buffalo. The order includes one direct-current reversing mill motor operating at 75 to 150 r.p.m. in either direction; one flywheel motor generator set consisting of one 4000-hp. wound rotor induction motor, two 2100-kw., 700-volt D.-C. generators, and one 100,000-lb. cast steel flywheel, and the auxiliary equipment consisting of a three-unit exciter set for the reversing mill motor and the generator of the flywheel set, apparatus for ventilating the main equipment, the switchboard and complete automatic control equipment.

To Buy Foundry Pig Iron by Analysis

Endorsement of the Proposal at Paris Congress—An International Committee on Cast Iron Testing—Papers on Handling and Testing of Sand

(Special Correspondence)

PARIS, FRANCE, Sept. 14.—The First International Congress of Foundrymen opened on Wednesday, Sept. 12, in the halls of the École Nationale d'Arts et Metiers de Paris. In connection with it there is a very large and interesting exhibit of foundry machinery and supplies. In cooperation with the Association Technique de Fonderie de France, which organized the congress, there were the Association Technique de Liége (Belgium), the Institute of British Foundrymen, the American Foundrymen's Association, the Association de Fonderie Tchéco-Slovaque, and independent foundrymen of Spain, Italy and other countries.

The exhibition had been opened on Sept. 2 by M. Dufour, president of the Syndicat général des Fondeurs de France, or the association of foundry owners, continued in active operation through the congress. The first congress session, Wednesday, Sept. 12, was opened by M. l'Abbé, Directeur de l'Enseignement Technique, as representative for the assistant secretary of state for technical instruction, who made a short address of welcome and introduced M. Emile Ramas, as president of the congress. With Director l'Abbé and President Ramas of the French Foundrymen's Association there were seated on the platform Messrs. Clamer, Stubbs and Leonard, respectively presidents of the American, British and the Belgian foundrymen.

M. E. Ronceray served as secretary of the congress and through his knowledge of the English language and indefatigableness in translating and abstracting papers and discussions gave value to the meetings for the English-speaking members, most of whom were not familiar with the French language. Probably 500 foundrymen attended the opening session.

Sand Handling and Testing

President Ramas read his opening address, which was followed by a greeting from American foundrymen, delivered by President Clamer of the A. F. A. The chair then called for the paper of Henry M. Lane, Detroit, on the "Mechanical Handling and Preparation of Sands." This was discussed briefly. Mr. Lane described the essentials of a molding sand bin, in that it must have a straight front, can slope inward back and sides, so that the conveyor underneath can empty the bin effectively. Also that it must be wide enough not to have the sand bridge.

Mr. Stubbs, president of the British foundrymen, addressed the meeting and urged close cooperation in the investigations before it—particularly in regard to the testing of cast iron and the purchase of pig iron by analysis. Next came the paper on "The Foundry and the Foundry Superintendent" by M. Léon Thomas, which was not discussed.

The paper by H. Holmes of Newcastle, on the "Necessity of Standardizing the Testing of Molding Sands," was not in print. It goes into the testing of molding sands by water current separation instead of by the American methods. The working of the method was shown later on by Mr. Holmes in one of the laboratories of the institution at which the congress was held. The paper of Mr. Hanley on the "Bonding Substance of Molding Sands" was read by title.

Joint Work on Testing

The paper by Dr. R. Moldenke on "Testing Cast Iron" was briefly outlined by him, with translation by M. Ronceray. This paper started the discussion of the day, and it was participated in by M. Portevain and others, with a written discussion by Mr. MacPherran of Milwaukee. Previous to the meeting, a dinner given by Walter Wood of Philadelphia gave opportunity to get the viewpoint of prominent French investigators on testing cast iron. Similarly, in England, at the several dinners given by the British foundrymen, the English viewpoint had been ascertained. Hence it became possible to reconcile these views in a resolution which was presented to the Congress by Secretary Ronceray, as follows:

> Resolved: That the International Congress of Foundrymen, assembled in Paris, recommends that the testing of cast iron be differentiated into testing of the quality of the iron entering the castings, from the testing of the quality of the castings themselves.
>
> That immediate steps be taken to study both subjects side by side, in the expectation that the first subject will be solved earlier than the second.
>
> That it is recognized that in no case will the testing of the quality of the iron give reliable information as to the quality of the castings made with it.
>
> That a joint committee be appointed from the nations here represented, to make suitable recommendations carrying this proposal into effect.

The above resolution was given in both French and English, and was seconded by Mr. Clamer for the United States, by Mr. Stubbs for England, with the understanding that the existing national commissions be intrusted with the actual work; by M. Leonard for Belgium, by M. Portevain for France, and then by representatives from Tchéco-Slovakia, Spain and Italy. After some further inquiries and discussion, the resolution was passed without a dissenting vote. Ways and means of carrying out the undertaking and the laying out of the problems involved will be taken up before the congress closes.

The last paper of the session was by M. Ledésert on "Methods of Testing Cast Iron." The afternoon was spent in visiting the exhibition, the exhibits of an educational character, the demonstration of the scientific apparatus for testing shown and the testing of molding sands.

Buying Pig Iron on Analysis

On Thursday, Sept. 13, the work of the congress was divided into two simultaneously held sessions, one for the French-speaking delegates and the other for those who could only speak English. Unfortunately, while the English papers had all been translated into French, the reverse was not the case, and hence the English visitors lost an advantage in not getting the presentation in a language they could understand. The discussions were also very meager on that account.

At the French session C. Adamson of Sheffield gave a brief summary of his paper on "Graphitization of Cast Iron," which was translated by M. Ronceray. In the discussion that followed, the president of the Tchéco-Slovak Foundrymen's Association desired the congress to take a stand on the subject of chemical specifications. This gave an opportunity for President Ramas to present the draft prepared by Walter Wood and Doctor Moldenke, embodying the tentative specifications of the A. S. T. M. for the purchase of pig iron by analysis. It is now before the blast furnace organizations of Great Britain and France. This draft of the American specifications was presented only as a statement of what was being done in the United States. It proved so interesting to the foundrymen assembled that a motion was made and carried indorsing the principle of buying and selling of pig iron by analysis, with proper tolerances and methods of sampling and analy-

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Eight Hour Shifts at Blast Furnaces

Southern Ohio Pig Iron and Coke Associations Receive Encouraging Report of Progress in Reducing Hours of Labor—Other Important Matters Considered

THE annual meeting of the Southern Ohio Pig Iron and Coke Association was held at Columbus, Ohio, Sept. 18, the members of the association, as well as the members of the Ohio section of the American Institute of Mining and Metallurgical Engineers being the guests of the Marble Cliff Quarries Co. for the day. The members were driven on arrival to the Scioto Country Club, where luncheon was served at 12.30, and after addresses of welcome to the visitors by W. H. Hoagland, president of the Marble Cliff Quarries Co., and R. H. Sweetser, president of the Southern Ohio Pig Iron and Coke Association, with responses by E. P. Mathewson, president of the American Institute of Mining and Metallurgical Engineers, and B. D. Quarrie, chairman of the Ohio section, the guests, 80 in number, were driven to the quarries for the tour of inspection. The company had fitted up a flat car with seats, and a fine opportunity was presented to see the latest methods in quarrying and preparation of stone for the market. The fact that it rained steadily during the inspection trip detracted not one whit from the interest displayed by the visitors, who made the entire trip as scheduled. The principal interest was, of course, shown in the preparation of blast furnace flux, a description of the method of quarrying, transportation, handling and washing of which appeared in THE IRON AGE of Sept. 20.

Following the inspection of the quarries the visitors were driven to the Columbus Athletic Club, where the guests were treated to an elaborate dinner, after which the meeting of the association took place.

This being the annual meeting, President R. H. Sweetser in an address reviewed the work of the association during the past year, and made some suggestions as to what should be taken up in the coming year. The most important of these was, in his opinion, the question of coal supply. On this question, Mr. Sweetser dwelt at some length.

Changing to the Eight-Hour Day

One of the most interesting reports, in the light of recent events, was that submitted by the committee on wages and hours of work. This report showed that a number of merchant furnaces in the district had already instituted the 8-hr. shift on continuous operations at furnaces. The plan was reported to be working very successfully from the standpoint of both employer and employee. At least two of the furnaces installing the three-shift turn reported that they had been able, by a better division of the work, to reduce the number of employees required to efficiently operate the furnace as compared with the number required while working two shifts. One furnace reported that it was able, with the same number of men, to operate as efficiently as under the old system. Reports to date indicate that the men are working more steadily and more efficiently under the new plan. The committee reported that it was a practical certainty that the 8-hr. turn will be installed throughout the entire district before the first of the year.

Transportation Facts

Some interesting figures on the transportation situation were given by Mr. Roney, of the traffic committee. For the week ending Sept. 1 the railroads of the country moved 73,000 more loaded cars than for any similar period in history. And at that time there was a surplus of 66,000 cars. The number of new cars put into service, as well as locomotives, and the decrease in bad order equipment, had been to some extent responsible for this showing. The average movement of cars had, however, been increased over 3½ miles per day, and the tonnage per car had also shown new high records, averaging now over 28 tons per car. The committee also compared the loadings of the different commodities during this week with the same period last year, showing that coal had made the greatest percentage of increase. The traffic committee also reported that it was now arguing a case before the Interstate Commerce Commission regarding the splitting of rates in the Ashland-Ironton district, which would give the manufacturers bordering on the south side of the Ohio River lower rates to the South and Southeast than those enjoyed by manufacturers bordering on the north side. These rates have already been put into effect on manufactured iron and steel products, and should the contemplated class rates be upheld will be put into effect on semi-finished products as well as on pig iron.

The committee also reported that coal mines, with the exception of those in West Virginia, had enjoyed an excellent car service to date, but that since Sept. 1 some mines had been handicapped by a shortage of coal cars. In this connection, Mr. Sweetser pointed out that a reduction of 1 per cent in the amount of ash in coal means an annual saving in cars alone of 120,000.

President Sweetser's Address

In his address, Mr. Sweetser stated that at previous meetings he had suggested that it would be well if the coal trade would adopt the customs of the iron ore industry and do business on the same high plane that iron and steel men conduct their affairs. He referred particularly to customs of the Lake Superior iron ore industry in buying and selling ore by analysis, transporting according to schedules and contracts made before the opening of each season and employing independent chemists who sample and analyze cargoes of ore in transit according to accepted scientific methods. In conclusion Mr. Sweetser said:

"These three sensible customs of the iron ore business, to wit: valuation by analysis, transportation by contract, and establishment of an independent group of coal samplers and chemists would help to place the coal trade on a higher plane as far as the iron and steel industry is concerned. And it is probable that in all their relations, the coal trade would be nearer right than under the present condition with all its artificial irregularities. The production and consumption of bituminous coal in connection with our own membership is of sufficient volume to be of importance and influence in the mining, transportation, and marketing of coal in the great coal producing States of West Virginia, Kentucky, Ohio and Pennsylvania. If the above proposition meets with the approval of the association, we can then proceed as we have done in the past in attacking the several practical problems of blast furnace and coke oven practice."

Coal Problems Discussed

A general discussion followed the delivery of the address, in which the members of the Institute of Mining and Metallurgical Engineers joined by invitation of the president. Some doubt was expressed by traffic experts as to the possibility of coal being shipped according to schedules worked out in advance, it being pointed out that there were over 17,000 coal mines shipping coal, whereas there were only a few ore shippers. On the question of selling coal by analysis, however, the members felt that some plan could be worked out. Approval was also given to the plan suggested of giving support to the establishment of a system by which independent chemists would sample and analyze coal the same as is now done on iron ore at the lake ports.

The association went on record, and will work to that end, in favor of selling coal by analysis, and also establishing a system by which coal shipment can be inspected and analyzed by independent chemists.

One of the objections to the selling of coal by analysis was that coal mines could hardly afford to sell coal by analysis. This objection was met by the statement that users of coal were able and willing to pay higher prices for coal of guaranteed analysis. Another objection to the plan was that there were too many coal mines in operation to make the plan feasible. It was stated, however, that there were practically as many mines and deposits of ore in this country as there were coal, but under the strict method of sampling and analysis enforced, it was found not practicable to mine the low-grade iron ores while those of higher iron content were more easily available. President Sweetser said that in his opinion it would be more profitable to the country if more of the coal now mined was left in the ground, the same as low grade iron ore, until such time as it was found necessary to mine it. There was plenty of good coal available to supply the needs of the country for the present, and with a plan of selling the coal by analysis the industries requiring a certain grade of coal would be able to get that coal with the least possible trouble.

The committee on blast furnace rating reported that the rule adopted by the association to rate the capacity of blast furnaces is being followed in many centers. The committee is anxious to receive any criticisms of the rule, and will welcome any suggestions.

The committee on membership reported 10 applicants for membership since the last meeting. These were elected by unanimous vote.

Election of Officers

The nominating committee handed in the following slate of officers for the coming year: President, R. H. Sweetser, re-elected for the fifth consecutive year; vice-president, Ashland district, George Hansen; vice-president, Ironton and Hanging Rock district, H. A. Berg; vice-president, Jackson-Wellston district, Walter Brown; vice-president, Portsmouth district, Peter Wielander; vice-president, Hamilton district, Jos. F. Savage; secretary-treasurer, Don H. Putnam.

Following the installation of officers, congratulatory addresses were made by a number of those present on the selection of Mr. Sweetser as president, and many tributes were paid him for assuring the success of the organization.

E. P. Mathewson gave a very interesting account of the trip of the members of the American Institute of Mining and Metallurgical Engineers to Canada last month. He was followed by a number of others, who discussed the business situation from different angles.

The meeting closed with a rising vote of thanks to Mr. Hoagland and his associates of the Marble Cliff Quarries Co. for the entertainment provided, and also for the opportunity afforded for an inspection of the quarries of the company. The next meeting of the association will be held later in the fall, at the call of the president.

Quad City Foundrymen's Meeting

Foundry coke was discussed from a metallurgical and practical viewpoint at a meeting of the Quad City Foundrymen's Association, Monday evening, Sept. 17. President Hageboeck of the association gave a short talk on the objects of the association, and explained briefly the program outlined for the current association year.

The following standing committees were appointed:

Cost committee: Davenport, H. A. Soverhill, chairman, Davenport Locomotive Works; Rock Island, Dave Kennedy, Tractor Works; Bettendorf, A. Reading, Zimmerman Steel Co.; East Moline, Elmer Gullberg, Union Malleable Iron Works; Moline, Louis Stone, Frank Foundries Corporation.

Industrial education: East Moline, Fred Kirby, chairman, Marseilles Works; Elmer Gullberg, Union Malleable Iron Works; Moline, Martin Carlson, Barnard & Leas.

Membership committee: Moline, E. H. Heartlein, chairman, Moline Sales Co.; Rock Island, William Seiffert, Tractor Works; Bettendorf, A. Reading, Zimmerman Steel Co.

Fellowship committee: Davenport, John Ploehn, chairman, French & Hecht; Rock Island, Leon Mitchell, Rock Island Stove Co.; Herman Alex, Rock Island Arsenal; William Seiffert, Tractor Works.

Sand research and international test bar: Moline, Henry Bornstein, chairman, Deere & Co.; Davenport, John Ploehn, French & Hecht; Bettendorf, F. V. Frew, Bettendorf Co.; Richard Hecschen, Zimmerman Steel Co.

Molding sand: East Moline, P. T. Bancroft, chairman, John Deere Harvester Works; Moline, Martin Carlson, Barnard & Leas; Lester Starner, Frank Foundries Corporation; Herbert Miller, Deere & Mansur; Charles Suhl, Tractor Plant; Roy Schoffer, Rock Island Plow Co.; Bettendorf, Fred Zimmerman, Zimmerman Steel Co.; R. L. Eichman, Bettendorf Co.

Green sand core: Rock Island, P. J. Schmitz, chairman, Blake Specialty Co.; East Moline, George P. Pearce, Union Malleable Iron Works; Rock Island, Charles Suhl, Tractor Plant.

The membership committee has put for its goal 100 active members and 100 plant representations in the form of sustaining members from all foundries in the Quad Cities.

The paper of the meeting was presented by Owen Pritchard, assistant general superintendent Milwaukee Coke & Gas Co., who explained the mechanical construction of the various departments in a coke-producing plant by using lantern slides which were furnished by the Pickands, Brown & Co., at Chicago. George A. T. Long, in charge of the service department of the Pickands, Brown company, spoke of the various elements in foundry coke that either tend to help or bother the foundryman. The discussion following lasted over one hour. The meeting was closed by an address by J. C. Mears, R. B. Co., St. Louis, who also has been in the pig iron and coke business for many years. He said he did not believe the local foundrymen appreciated the value and the benefit of an association such as that of the Quad Cities.

Brass Manufacturers Meet

The National Association of Brass Manufacturers held a well-attended fall meeting in the Old Colony Club, Hotel Cleveland, Cleveland, on Sept. 11, 12 and 13.

The newly established credit department, on report of Commissioner W. M. Webster, showed some splendid results. The standardization committee tendered a report, also the committee on standard gages for uniform sizes of tapers and threads of all basin and bath faucets.

The die committee has rechecked the models made by the Greenfield Tap & Die Corporation and substantially all members of the association promptly placed their order for a set of these gages, which will not only provide a uniform and interchangeable system of threads for plumbing fixtures so that the goods made by a member in the Far East will interchange with those made by a member in any other section of the country, but the saving was marked in what these gages might be provided for. This will be another advantage, it is emphasized, that the jobbers will have in procuring their goods from members of the association.

Work is progressing on the new official catalog, which will be issued on Jan. 1, 1925.

The association indorsed the action of the Middle West Foreign Trade Committee in regard to its merchant marine program, and recommended that each member of this association write to his United States Senator and Congressman, asking that they support a

proper bill calling for private ownership and operation of American ships, to be fostered and encouraged by the United States Government.

A committee of three was appointed to cooperate with the National Trade Extension Bureau on the question of standardization of catalogs, more particularly to assist this committee than anything else, as this association has adopted a standard uniform size of 7½ x 10⅝ in. The committee was instructed to encourage no change, which is so near to that suggested by the National Trade Extension Bureau, unless some very marked and practical reasons can be offered for making the change, in which case the committee was instructed to report back.

State of Business

The report made at the conclusion of the final session on general business conditions showed that a number of members were making goods for stock. On an average the members had sufficient business on their books to operate their plants for over a month. The majority reported that they were operating their plants full force and full time, some stating they were working overtime. The wage and labor question seems to be more or less of a tranquil nature.

The convention adjourned to meet in New York City on Wednesday and Thursday, Dec. 12 and 13.

Engineers' Society of Western Pennsylvania Addressed by A. E. Crockett

A. E. Crockett, manager bureau of instruction, Jones & Laughlin Steel Corporation, Pittsburgh, gave an interesting talk to members of the Engineers' Society of Western Pennsylvania on river transportation Tuesday evening, Sept. 25. Mr. Crockett has given the subject of inland waterways considerable study, and has been heard in various parts of the country in advocacy of greater use of the rivers to supplement the transportation service of the railroads. In his talk, which was illustrated by lantern slides, Mr. Crockett outlined the development of the inland waterways as transportation arteries, giving a particularly graphic story of the development of the Ohio River and a glimpse into the future of that river when the locks and dams along its more southerly reaches, for which the Government has already appropriated funds, are completed. William McConway, president of the McConway & Torley Co., Pittsburgh, also was a speaker at this meeting, explaining motion pictures and lantern slides detailing the McConway method of centrifugal casting of steel ingots. This method was described in an article in THE IRON AGE of Feb. 1, 1923, page 337.

Expanding Activities of the Steel Construction Institute

The American Institute of Steel Construction up to the present time has been conducted with a view of establishing a broad and sound foundation for future development. Much of this work has been of a technical character and centers around the adoption of a standard specification, publication of which was noted some time ago in these columns. The board of directors at the beginning of the year decided that when this work had reached a proper stage there would be need for additional talent to conduct the affairs of the institute to assist L. H. Miller, who was then engaged as the managing director.

At a meeting of the board of directors held in New York on Sept. 13, Charles F. Abbott was engaged for this purpose. Mr. Abbott is experienced in practical business as well as industrial organization effort along the lines contemplated in the organization. He will direct the work of the organization from an office in New York, and Mr. Miller will continue his work with the organization at his present location in the Leader News Building, Cleveland, as its chief engineer in the promotion of the technical phases of the institute.

Drop Forgers at Steel Treaters' Convention

The executive committee of the Drop Forgers' Supply Association held a meeting in Philadelphia recently, and it was decided to make a concerted effort to invite as many drop forgers as possible to attend the convention and exposition of the American Society for Steel Treating to be held in Pittsburgh, Oct. 8 to 12.

Inasmuch as the drop forge industry is so closely allied to the aims and purposes of the A. S. S. T., all of the members by attending have been able to obtain great benefit from the many papers that are to be presented on that subject, and also by visiting the exhibitors.

On Wednesday afternoon at 3:30 there will be a round table discussion on the subject of "Large Forgings." At this session papers will be presented on forging subjects as well as forging costs.

The drop forgers visiting the convention are requested to make that fact known at the registration desk so that they may attend the informal drop forge dinner to be held on Wednesday evening, Oct. 10, at 6:30, previous to the annual dance of the society.

The Hudson Sheet & Tin Plate Co., Marietta, Ohio, in liquidation, has been purchased by W. F. Robertson, of the W. F. Robertson Steel & Iron Co., Cincinnati, for $84,000. Whether the mill will be put into operation has not been definitely determined by Mr. Robertson, but an official announcement as to his intentions is expected to be made this week.

COMING MEETINGS

September

Association of Iron and Steel Electrical Engineers. Sept. 24 to 28. Convention and exhibition, Broadway Auditorium, Buffalo. J. F. Kelly, 1007 Empire Building, Pittsburgh, secretary.

American Electrochemical Society. Sept. 27 to 29. Annual meeting, Dayton, Ohio. Dr. Colin G. Fink, Columbia University, New York, secretary.

October

National Safety Council. Oct. 1 to 5. Twelfth annual meeting, New Statler Hotel, Buffalo. W. H. Cameron, 168 North Michigan Avenue, secretary.

American Society for Steel Treating. Oct. 8 to 12. Annual convention, Motor Square Garden, Pittsburgh. W. H. Eisenman, 4600 Prospect Avenue, Cleveland, secretary.

West Virginia and Kentucky Association of Mining, Mechanical and Electrical Engineers. Oct. 19 and 20. Third annual convention, Hotel Frederick, Huntington, W. Va.

American Society of Mechanical Engineers. Oct. 23 and 24. Regional meeting, Chattanooga, Tenn. E. C. Patterson, general manager Chattanooga Boiler & Tank Co., Chattanooga, in charge of details.

National Association of Farm Equipment Manufacturers. Oct. 24, 25 and 26. Thirteenth annual convention, Statler Hotel, Cleveland. J. B. Bartholomew, Peoria, Ill., president.

American Welding Society. Oct. 24, 25 and 26. Fall meeting, Pittsburgh. M. M. Kelly, 33 West Thirty-ninth Street, New York, secretary.

American Iron and Steel Institute. Oct. 25, fall meeting in New York; Oct. 26, visit to Aberdeen Proving Ground, Md. E. A. S. Clarke, 40 Rector Street, New York, secretary.

Society of Automotive Engineers. Oct. 25 and 26. Production meeting at Cleveland. Coker F. Clarkson, 29 West Thirty-ninth Street, New York, general manager.

American Gear Manufacturers Association. Oct. 25, 26 and 27. Fall meeting, Mountain House, Lake Mohonk, N. Y. T. W. Owen, 2443 Prospect Avenue, Cleveland, secretary.

American Management Association. Oct. 29 to Nov. 1. Annual convention, Hotel Astor, New York. W. J. Donald, 20 Vesey Street, managing director.

Machine Tool Exhibit at Yale University

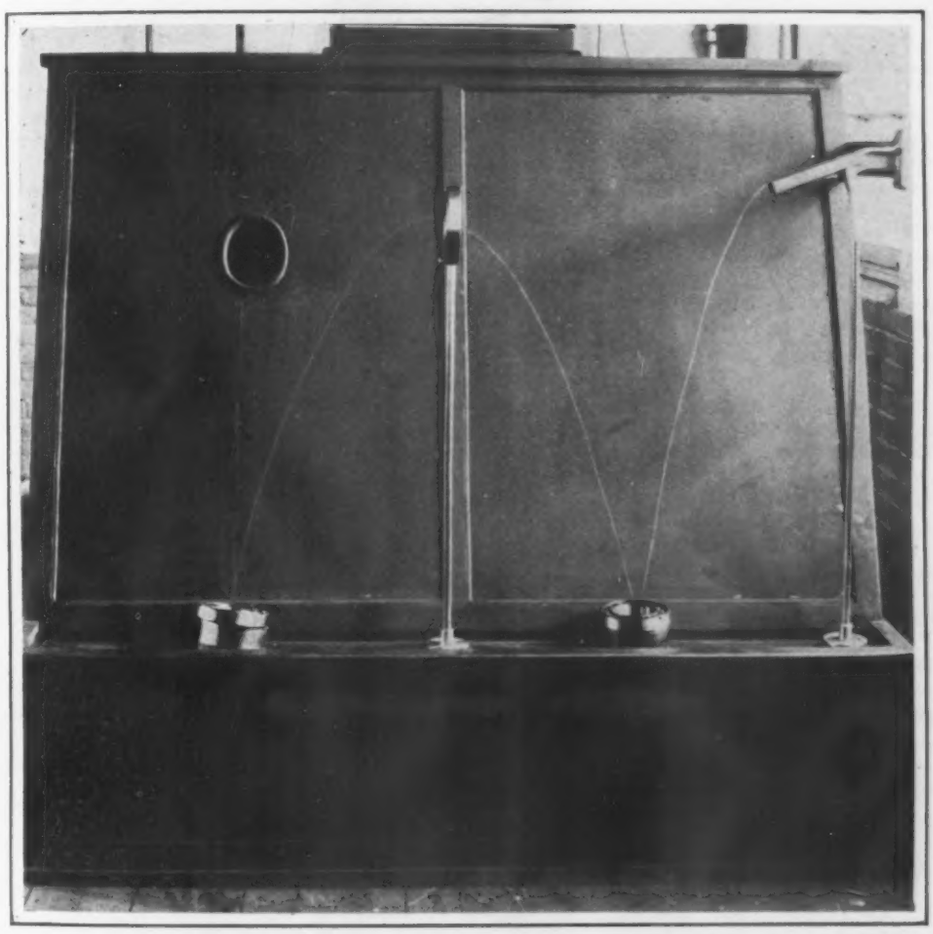
Some of the Unusual Features—Caliber of Visitors Apparently of Higher Order Than Heretofore—Resolutions of Appreciation to Yale University

THE four-day session of the third annual machine tool exhibition held under the joint auspices of Yale University, the New Haven section of the American Society of Mechanical Engineering and the New Haven Chamber of Commerce closed in Mason Laboratory of mechanical engineering, New Haven, Conn., Sept. 21. This year there seemed to be fewer of the curious class among the visitors and more of the potential buying power and they came from a wide area, visitors being reported from as far away as Baltimore, Cincinnati, Pittsburgh and Buffalo. Many master mechanics, production managers, plant engineers and superintendents were among the number. Marked interest was shown in the demonstrations and some of the evening meetings were poorly attended, visitors preferring to see machines in operation rather than to hear the addresses.

Among the papers prepared to follow the opening address and the address of welcome were one on "Yale and the Machine Tool Industry," by Charles H. Warren, dean of Sheffield Scientific School, and one on the "Broader Aspects of Machine Tool Applications" by Prof. Herbert L. Seward, also of the Sheffield Scientific School. On the second evening meeting were presented papers on "The Origin of Machine Tool Building" by Joseph W. Roe, professor of Industrial Engineering, New York University, and "An Industrial Birthplace of Pioneer Machine Builders," by E. Guy Hubbard, engineer at the Gridley plant at Windsor, Vt., of the National Acme Co.

A rather novel procedure featured the third evening meeting. Some of the new machine tools were removed from the exhibition floor to the auditorium where they were demonstrated in operation, with opportunity for discussion and explanation. It is planned to make this an annual feature to acquaint visitors with the newest devices on the market.

At a meeting of exhibitors held on the last day, resolutions of appreciation were drawn up for presentation to William Smith Mason and George Grant Mason, Yale 1888, donors of the Mason Laboratory and to Yale University for the opportunity given the machine tool industry through these exhibitions to advance that branch of the science of mechanical engineering. These resolutions were signed by the individual in charge of each exhibit.



Sphericity and Uniform Hardness of Balls Used in the Modern Ball Bearing Are Shown by the Test Staged by the New Departure Mfg. Co. This illustration was made from a time exposure. Due to this fact the track developed by the balls following each other in a parabolic curve registered clearly on the negative. Had there been any non-uniformity in the track of the balls the impression would not have been sufficiently heavy to register on the plate, or it would have been wavy or broken

List of Exhibitors

Abrasive Machine Tool Co.; Alexander Brothers; American Blower Co.; B. C. Ames Co.; Anderson Die & Machine Co.; Atlas Ball Co.; The Atlas Steel Corporation.

The Baird Machine Co.; Billings & Spencer Co.; Bentley Holmgren Equipment Co.; The Bilton Machine Tool Co.; Botwinick Bros.; Brown & Sharpe Mfg. Co.; The Bullard Machine Tool Co.

A. C. Campbell, Inc.; Carborundum Co.; S. W. Card Mfg. Co.; The Cushman Chuck Co.

Detroit Belt Lacer Co.; Detroit Twist Drill Co.; Diamond Machine Co.; R. & J. Dick Co., Inc.

Eastern Machine Screw Corporation; Eggleston Supply Co.

The Fafnir Bearing Co.

Garvin Machine Co.; General Electric Co.; The Geometric Tool Co.; Grant Mfg. & Machine Co.

The Hanson-Whitney Machine Co.; The Hanson Tap & Gage Co.; Haynes Stellite Co.; The Hendey Machine Co.; The Henry & Wright Mfg. Co.; The Heppenstall Forge Co.; Hergi Mfg. Co.; The High Speed Hammer Co., Inc.; The Hoggson & Pettis Mfg. Co.

Ideal Machinery Co.

Jacobs Mfg. Co.; Jones & Lamson Machine Co.

Keller Mechanical Engineering Corporation; Kingsbury Mfg. Co.

Leland-Gifford Co.; J. L. Lucas & Son, Inc.

Machinery Dealers Incorporated; R. H. Madden Co., Inc.; Manning Abrasive Co.; C. S. Mersick & Co.; Monarch Machine Tool Co.

The National Acme Co.; Friedrich Neumann's Successors, Inc.; The New Departure Mfg. Co.; The J. M. Ney Co.; Nicholson File Co.; The Noble & Westbrook Mfg. Co.; The Norma Company of America.

Ohio Machine Tool Co.; Ohio Valley Pulley Works; The Oven Equipment & Mfg. Co.

The Page, Steele & Flagg Co.; Peerless Machine Co.; Peerless Surfacing Machine Co.; Potter & Johnston Machine Co.; Pratt & Whitney Co.; Purinton & Smith.

Racine Tool & Machine Co.; Reading Automatic Machine Co.; Ready Tool Co.; Reed-Prentice Co.; Rhodes Mfg. Co.; Richards & Co.; Rivett Lathe and Grinder Corporation.

Sellew Machine Tool Co.; Seneca Falls Mfg. Co.; Sidney Machine Tool Co.; Simonds Saw and Steel Co.; Sipp Machine Co.; S. K. F. Industries; The Skinner Chuck Co.; J. T. Slocomb Co.; The Springfield Machine Tool Co.; Standard Safety Mfg. Co.; Standard Steel & Bearings, Inc.; Stark Tool Co.; J. S. & J. F. String.

The Taft-Peirce Mfg. Co.; The Taylor & Fenn Co.; Torchweld Equipment Co.; The Torrington Co.; Triplex Machine Tool Co.

Union Twist Drill Co.

Van Norman Machine Tool Co.

O. S. Walker Co.; J. D. Wallace & Co.; The Warner & Swasey Co.; Waterbury-Farrel Fdy. & Mach. Co.; A. F. Way Co., Inc.; Westinghouse Electric and Mfg. Co.; Whitney Mfg. Co.; Wickes Bros.; Wisconsin Electric Co.; Wright Mfg. Co.; The Yale & Towne Mfg. Co.

Many of the manufacturers exhibited in space reserved by their representatives in the New England district. Thus the demonstrations of several builders were grouped and appeared as the exhibition of one of Connecticut's machinery dealers. Most of these displays were of more or less well known lines and included items which have been on the market for some time. Other manufacturers presented entirely new products together with those which had been shown before. Many accessories not properly classified as machine tools were seen.

Probably the most spectacular exhibit and one which savored of a real scientific demonstration was that of the New Departure Mfg. Co., ball bearing manufacturer of Bristol, Conn. In this exhibit the uniform quality of the modern ball bearing was demonstrated. Uniformity of material, heat treatment and dimension of ball races was shown by a xylophone arrangement of races of varying sizes which would vibrate to different wave lengths when struck with a mallet or beater. That part of their exhibit which attracted most attention was one in which the balls to the lay mind would appear to be bewitched. Balls were fed up through a standpipe to a trough, down which they rolled to drop upon a hardened steel disk. A motor driven device inclosed in the platform forced the balls up the standpipe. Balls dropping one after the other from the trough would rebound from the disk, describe a parabolic curve, pass through a bearing mounted on a stand, and, dropping, would rebound from a second disk into a hole in the inclined wall behind the apparatus. Not one ball but seemingly thousands in a continuous performance followed the same course. Occasionally one ball out of several thousands would miss the hole. It was found when this happened that the ball had picked up a speck of dust which was sufficient to deflect it on striking. The demonstration depicts uniform quality of chrome alloy, forged, heat treated steel balls, alike in hardness, size and sphericity.

The Pratt & Whitney Co., Hartford, Conn., among other machines, gages and small tools, showed the new model geared-head lathe in which the back gear shaft is hung directly below the spindle and the motor mounted in the cabinet leg. This machine was recently described in THE IRON AGE.

The Skinner Chuck Co., New Britain, Conn., showed its new S line of independent chucks in which the chuck plate recess is set more deeply into the body of the chuck thereby reducing overhang when mounted on the lathe spindle. It is claimed that at the same time weight has been somewhat increased. This chuck also has what are called self-alining thrust bearings for the jaw screws. Another line shown by this company is a quick acting milling machine vise, formerly known as the Ketcham vise before taken over by the Skinner company, in which the width of jaw opening is governed by an adjustable spanner nut, while the opening and closing in operation of the movable jaw is actuated by an eccentric handle.

The Bullard Machine Tool Co., Bridgeport, Conn., showed a "mult-au-matic" turning, boring, reaming and facing a cam shaft gear blank as used in the Jewett motor car. This blank was 7½ in. in diameter with a face of 1⅝ in. and machining was completed at the rate of one every 57 sec. with dimensions accurate within 0.001 in.

The Yale & Towne Mfg. Co., Stamford, Conn., among products displayed, showed the new tier lift industrial electric truck which was described in THE IRON AGE several weeks ago.

The Cushman Chuck Co., Hartford, Conn., exhibited for the first time its line of lathe and boring mill face plate jaws and the new combination tri-plex chuck, which is claimed to be self-centering, independent, or eccentric. It has a scroll plate for the universal action. When the jaws have been used in independent motion, they may, it is claimed, be more readily set for concerted or self-centered action than in previous types of combination chucks.

Andrew C. Campbell, Inc., Bridgeport, Conn., displayed two new sizes of the Campbell nibbling machine in addition to the size displayed at the show last year. These two new sizes provide for a cutting capacity up to ⅜ in. and a throat depth of 24 in.

One exhibit of particular interest to core makers and japan bakers was that of J. S. & J. F. String, New Haven, Conn. This was a core baking or japanning oven equipped with automatically controlled oil firing. A thermostat controls the switch governing the blower motor. Beside the oil burner is a gas pilot light. When the operator starts, it is simply necessary for him to throw in the line switch to start the blower and light the pilot. Oil is brought to the burner and atomized as the air pressure is built up by the blower. As soon as oil starts to feed, it is ignited. When the furnace reaches the pre-determined temperature, the thermostat acts to open the electric switch, closing it again when the temperature has reached a pre-determined low point. It is claimed that the device is accurate to within 4 deg. The thermostat is adjustable. After starting, with the pilot burning, the oil may be turned on or off like gas.

The Jones & Lamson Machine Co., Springfield, Vt., in addition to displaying the Jones & Lamson turret lathe in operation, the comparator, and the Hartness die head, also exhibited a line of ground thread taps which it is marketing under the name of the Flanders ground tap.

The Haynes Stellite Co., New York, had on display a number of solid milling cutters developed since the last exhibition, to supplement its line of inserted blade cutters.

President Werner to Speak on the Schuermann Cupola in Chicago

Siegfried G. Werner, president of the German Foundrymen's Association and holder of the patents for the Schuermann cupola, is expected to arrive in this country the latter part of October, when he will visit the plant of the Griffin Wheel Co. at 445 Sacramento Boulevard, Chicago, where a cupola of this type is now being installed. Tentative arrangements have been made to have Mr. Werner address the Chicago Foundrymen's Club on the Schuermann cupola Saturday evening, Nov. 10. On the same day, from 9 a. m. to 2 p. m. the Griffin company will open its plant to visitors desiring to see the cupola in operation. Mr. Werner was employed in this country by the American Steel & Wire Co. for a period of three years and speaks English fluently. The Schuermann process of preheating the blast for the cupola in stoves to shorten the time of melting was described in THE IRON AGE of Oct. 19, 1922.

The Prime Mfg. Co., Milwaukee, plans the erection of a brass foundry with a floor space of about 15,000 to 16,000 sq. ft.

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The Right Price for Steel

MUCH of the comment of the past two months on the course of the steel market has ignored a factor that has contributed largely to the present situation. We have read frequently of the "seasonal" influences that held back new buying of steel products in the summer months and that were expected to give way in the early fall to a revival of demand on a broad scale. It is quite well recognized now that to a large extent this "seasonal" factor was a talking point for commentators who felt called on to come to the help of a situation that was working itself out in an old-fashioned way.

Naturally, much that has been said in recent months about the steel market has been true of other commodity markets. All have been operated upon by a variety of forces—some of these growing out of the war and affecting the world, while others represent a complicated economic and political situation at home. All shared to a greater or less extent in the rapid expansion of demand in the first four months of the year and now have somewhat moderated their pace. Thus the present condition was described in one of the last week's commercial reviews as due to the fact that "requirements were largely covered ahead during the noteworthy commercial revival of earlier months this year."

But the steel market has had in some respects a situation of its own. It was particularly hard hit in output by the coal and railroad shop strikes last year. The very low prices for steel in the early months of 1922 started a general restocking movement in compensation for the beggarly buying of 1921. The double strike interrupted the restocking, but it was resumed late in 1922 and carried over into the early months of this year. When there was added to it the building expansion of last spring and the heavy buying of the railroads, it seemed to many consumers of steel that they would not be able to get deliveries of material as needed. That fear proved groundless. Deliveries of steel in the first eight months of 1923 were on a scale never equaled.

It became evident early in the summer, however, that consumption, great as it was, would not require such a full operation of plant as had made April and May peak months in all our history. Curtailment has been so gradual that four months of it have left production within 15 to 20 per cent of the high rate. Prices, which at the opening of the year were 2 cents for plates, shapes and bars, advanced steadily under the heavy buying of the first quarter, until for early delivery they were well above 2.50 cents, and on contracts were easily established at the latter figure for plates and shapes and at 2.40 cents for bars. But shipments are still being made, and have been for months, of material bought well below 2.40 and 2.50 cents, so that consumers have not had to figure the prices of their own products on any such basis for steel as today's. Car builders, for example, have put much 1.70 cent and 1.80 cent steel into the cars they have been delivering to the railroads this year. They have yet to find out whether they can sell cars at the prices they must get if they pay 2.50 cents for steel.

Coming back, then, to the statement with which we began, the price factor, which has figured but little in reviews of the steel situation, is the one to which the whole trade presently will be giving a great deal of attention. Buyers whose 1923 product has been based on steel costing from $10 to $15 less than is asked today must decide how much business they can do if they must advance their prices to the basis of today's level for steel, and then buy accordingly. It is a situation in which both sides of the market will soon be engaged in one of the familiar efforts that have followed every considerable market advance, to answer the question what is the right price for steel—the price at which there will be the largest possible consumption, under existing business conditions, of the secondary products into which steel so largely enters.

A PREDICTION at the close of the war that five years later the iron and steel buying by the nations from one another would be less than it was before the war would not have been accepted. The combined exports of the six leading exporting nations—United States, Great Britain, France, Germany, Belgium and Luxemburg—has

risen to only 1,017,400 gross tons per month this year against 1,350,000 tons per month in 1913. The monthly total in 1920 averaged 955,600 tons and in 1922, 982,350 tons. Yet prodigious figures have been offered repeatedly as estimates of the steel shortage caused by the war's absorption. Presumably what the world has struggled along without, it is not now concerned about; indeed, it could be said that it has allowed the shortage to increase.

Passing of the Coal Commission

LAST week the U. S. Coal Commission came to the end of its statutory life and passed out of existence, having previously addressed a series of reports to the President. These have been verbose and inconclusive. The commission has told to economists and engineers and the persons engaged in the coal mining industry nothing very material that they did not already know. It was never expected that it would. The most that was hoped was that it would inform the general public respecting coal mining conditions in a lucid and convincing way. Indeed, that was the primary function of the commission, for as a public body it could speak to the people, through the President, with a voice of authority and widespread circulation and instructiveness. In that primary function the commission has signally failed.

In its concluding report the commission recommends the use of the powers of the Federal Government over interstate commerce, through a spcially created division of the Interstate Commerce Commission, "to regulate the coal mining industry, recognizing that under our constitutional system a substantial part of the responsibility rests on the State and local governments and should remain there, and an even larger part on the industry itself and the public which it serves."

There is a good deal of hedging in that declaration and in the more specific ones that follow. The commission intimates that the industry itself and the consuming public ought to take care of themselves, but it does not venture to say that both would be in a better position to do so if they should be unhampered. On the contrary, the commission proposes further restrictions and supervisions. This is clearly opposed to the evidence that what the coal mining industry needs is liberation from existing economic and political restrictions, not the imposition of more of them.

The commission said among other things "the main remedy against extortionate prices lies in the consumer himself. There are substitutes for hard coal, and a readiness to resort to them is the ultimate and effective defense against an unreasonable price." This rubs it in to the consumers of domestic sizes of anthracite who have already heard of advances of 50 cents to $1 per ton in the prices f.o.b. mine and who are thinking of Governor Pinchot not merely as the man who settled the strike but also as the one who put up the price for coal. However, the U. S. Coal Commission again is only partially right. The coal consumer himself is helpless. He can not use substitutes unless they be offered to him.

The real immediate solvers of the predicament of the consumers will be the entrepreneurs and engineers who offer substitutes to them. We are glad, therefore, that the powerful petroleum producers are right on the job, as, of course, they would be. At the convention of the National Petroleum Association last week, Henry L. Doherty expressed the belief that from now on one seller of petroleum products after another will be establishing tank wagon routes to deliver oil for house heating and small industrial uses, it being his opinion that probably the biggest potential market of the petroleum industry is the domestic use of oil for heating. We may be sure that inventors and manufacturers of oil burning apparatus will be encouraged, and although the simple oil burner for the house heater may not yet have been devised, it will come and will afford much more hope for the consumer than anything that the U. S. Coal Commission has recommended.

Stocking Coal Against a Strike

THE very unsatisfactory character of the United States Coal Commission's 7500-word report was commented upon briefly but emphatically in THE IRON AGE last week. There is general disappointment over the report, and it is impossible to see that the commission has done much to pave the way for a proper settlement of bituminous coal mining wages for the period beginning April 1, 1924. In the interest of the public, a mining suspension should be avoided and wages should be brought down to a reasonable level.

Hope of the coal commission's settling this matter being abandoned, the question is, what next? There is unlikely to be any great public movement, and Congressional action, in advance of trouble at least, cannot be expected.

A question remaining is, what will consumers do in the matter of stocking? If a consumer stocks and there is no strike, he loses the cost of stocking and probably part of the purchase price, nce prices would probably be lower while he was liquidating the stock. If he does not stock and there is a strike, he loses, as he will have to pay high prices.

These alternatives are taken on the basis of the matter of strike or no strike being predetermined, but there is also the question what influence stocks would have upon the matter. Many men have readily embraced the idea that the way to prevent a strike is to stock heavily, then the miners will see that they cannot hold out long enough to win, but what prospect of work on April 2 does the miner have if there are large stocks, or where would the operator be? There have been many cases in the past quarter century of operators and miners disagreeing for a few weeks and then suddenly coming to terms, when it appeared rather plain they were simply waiting for stocks to be liquidated.

On the basis, however, of stocking being a strike preventive and an expense to the consumer, the individual consumer may be disposed to let some one else do the stocking. Altogether, there is no clear view as to what consumers are

going to do, or what effect any particular action would have.

Enormous stocks can easily be accumulated by April 1, for there are large stocks already. In anthracite a full twelvemonths' production is commonly taken at 90,000,000 net tons, and it requires only a little production this month, since the recent resumption, to make the total for the six months, April 1 to Oct. 1, one-half of this, or 45,000,000 tons. Anthracite is therefore well able to take care of itself.

As to bituminous coal, production in the first eight months of the year is reported at 367,260,000 tons, this being the second best total on record for the period, the record period being in 1918. The last Geological Survey report showed 51,000,000 tons of commercial stocks Aug. 1, while the record high stock was 63,000,000 tons, both on Armistice Day and on April 1, 1923. An increase of 5,000,000 tons was reported for July, and similar increases in August and September would bring stocks practically up to the high record by Oct. 1, with six months still to go. Thus, if consumers are convinced that large stocks will kill the strike prospects and are willing to cooperate, full physical facilities are available.

A Problem for Steel Makers

IT is worthy of note that the microscope—powerful investigative weapon though it is—has had little use in the every-day routine of steel production or heat treatment. Workmen still rely almost exclusively upon the ancient method of examining the fracture of a test piece made by empirical methods. Minute differences in appearance, as viewed by the skilled eye, mean large differences in the quality of the parent metal. Only when a quite unusual structure is revealed is the sample referred to the laboratory for attention, and the research men then bring the microscope into play.

Is it not true that the reason for so few microscopes getting into the mill is not the delicacy of the instrument or manipulation, for chemical analysis has surmounted this objection, but the fact that no one has yet been able to correlate what the bare eye sees with what the microscope reveals? Whatever it is that produces "flaky" fractures in nickel steels, an immense amount of microscopic study has failed to find it. And no one knows what is the nature of that peculiar fibrous fracture desired in test pieces from armor plate and heavy forgings. (It is not entirely due to solid impurities in the steel, for it is possessed by heat-treated plates made at Charleston from superfine electric steel.)

Or, referring to everyday affairs, "black fracture" in carbon tool steel has been shown by the microscope to be due to graphitized cementite. Yet, if that same steel be hardened, it would pass inspection under any microscope, but would be instantly discarded by the skilled inspector because of its "dry" fracture.

We venture to suggest that the reason for this mismatch of works and laboratory is that in general macrostructure is due to primary crystallization, microstructure to secondary. The fracture of a specimen is primarily influenced by idiosyncrasies developed during solidification; while the metal is passing from the liquid to the solid state in the mold. Microscopic investigation, on the other hand, has to do almost exclusively with the much finer crystalline units formed during the time the steel is cooling through the critical ranges when the solid solution austenite transforms into pearlite and other intermediate substances.

These latter transformations are of first importance to the phenomena of hardening, and the industrial world owes a great debt to the scientists and laboratory investigators who have evolved a rational theory to guide the practice of heat treatment. But more laurels await studies in the almost neglected field of structure visible to the naked eye, or at a few diameters magnification. In that field we must look for information if we are to make progress in improving the structure of castings. Such studies will help clear up many doubtful questions about the refining stages during steel making, and develop a rational explanation of the process. Also they will answer such questions as: How little reduction by forging is a necessary preliminary for refining the grain by heat treatment; how much is necessary to cause the development of "flow lines?" For that matter, is the banded structure of "flow lines" necessary, preventable or desirable even if preventable?

Heat treaters have done yeoman service in showing the practical utility of the microscope. Recognizing its adequacy they are turning to the method of deep etching or pickling to develop the coarser structure of their metal. Professor Sauveur recently has written a scholarly paper for the American Society for Steel Treating appraising the entire situation and asking pertinent questions about dendritic segregation. But it would seem really to lie in the province of steel makers, rollers and smiths to explain the riddle of "fracture."

AN international exchange of commercial students is urged by the Chamber of Commerce of the United States. Just as there are now abroad American students of art, literature and the sciences, while students from foreign countries are similarly occupied in this country, so there is promise in some organized arrangement which will send the commercially inclined American overseas to learn trade customs, institutions and language. At the same time the young foreign business student desirous of gaining familiarity with practices in the United States will be studying here. It remains for the American chambers of commerce abroad to secure berths for Americans in their local industrial establishments and for business organizations here to do likewise for the foreigners nominated, say, by the American associations abroad. The chief need in establishing the exchange idea is the setting up of the central bureau to bring both ends together.

British Machines Long Lived Yet Efficient

American Foundrymen See Interesting Processes and Equipment in Birmingham and Manchester

(Special Correspondence)

LONDON, ENGLAND, Sept. 11.—On arrival at Birmingham Tuesday evening, Sept. 4, the party of American foundrymen was received by the local committee and cared for at the Queen's Hotel. Wednesday, Sept. 5, was devoted to plant visitation. The first stop was at the famous plant of W. & T. Avery, Ltd., manufacturers of precision scales and a variety of other metal products of high grade. The old firm name was Boulton & Watt, and the first engine in England was built and operated here. The date is from 1776 to 1898, when this engine was placed in a museum for exhibition. The American visitors were much astonished to see some very ancient but none the less efficient machinery in operation. A huge lathe in daily operation has been running for over 125 years constantly, and a duplicate screw for feed, which had been placed on the wall to serve for replacement, has been there over 40 years without prospect of being brought into requisition for a long time to come yet. A radial drill has been in operation over 100 years and is still as efficient as any modern tool. The man running it has done so for over 57 years. The original works clock, put there in 1802, is still serving well. All of which shows the degree of skill in designing the machinery in the first place, and the excellence of the materials used.

Some of the processes and equipment the American visitors are seeing on this trip are of highest interest. While in Manchester, some of the party ran out to Stanton, to the blast furnace and large pipe plant of the Stanton Iron Co., where pig iron is made with raw coal instead of coke, and where, in the pipe plant, the DeLavaud process of making centrifugally cast iron pipe has been brought to a high degree of perfection.

The second plant visited in Birmingham was that of the Birmingham Aluminum Casting Co., where much of the work was done in iron molds, some of very intricate form. This is not the die casting but real permanent mold work. A visit to the Midland Motor Cylinder Co. plant completed the afternoon. Here aeroplane and auto-cylinder castings are made in great variety, as well as complete engines. Birmingham is peculiarly the cradle of the larger iron development of England, for here Dud Dudley succeeded in making the first coke and replacing charcoal in furnace practice.

The dinner of the evening was a splendid affair. Prof. Thos. Turner acted as chairman. A formal reception preceded and gave opportunity for renewal of friendship and the forming of new ties. President Clamer of the A. F. A. proposed the formal toast to the King, while Professor Turner did the honors for the President of the United States. "Our Guests" were then toasted by Gilbert C. Vyle, the managing director of W. & T. Avery, Ltd., with a happy response by Jesse L. Jones, of the American party. V. E. Minich then lauded the city of Birmingham and the foundry industry in an interesting address and gave the toast to the gathering. This was responded to by the Lord Mayor of Birmingham, Alderman Sir David Davis, J. P., who had brought Lady Davis with him.

The last toast, "The Ladies," was given by Sir Herbert Austin, M. P., in a speech which gave the Americans an idea of how woman's suffrage is regarded in parliamentary circles. The response to this toast was the event of the evening, and was given by Mrs. G. H. Clamer in a most happy and humorous vein, and was thoroughly enjoyed by every one present. Music finished up the evening.

The following day, Thursday, Sept. 6, was devoted to plant visitation in the Coventry District, to which the party was taken by train. The shops of the Daimler company were visited first, and the several divisions inspected with much interest. After lunch in the Masonic Hall, the party went to the plant of the British Piston Ring Co., and the special production was examined with much interest. The Sterling Metals plant with its variety of interest then claimed the attention of the visitors, after which the party entrained at Coventry station for Birmingham again.

Friday, Sept. 7, was given up to a sightseeing trip by motor car to the ruins of Kenilworth, to Warwick Castle, and to Shakespeare's country with all its mementoes, arriving at London in the evening. Saturday and Sunday were set aside as days of rest, in view of the strenuous nature of the trip ahead. Monday, Sept. 10, was filled by an official visit to the Shipping, Engineering and Machinery Exhibition at Olympia, London, where the party was also entertained at lunch.

Tuesday afternoon, Sept. 11, the party left for Paris, via Dover-Calais, thus closing up a most eventful, enjoyable and important visit of American foundrymen to the foundrymen of Britain. Much will come of this close association in the future, and it is hoped that American foundrymen may welcome a British delegation in 1926, at the Philadelphia Exposition, if not before that time. R. M.

To Standardize Stove Bolts

An effort is being made through the cooperation of makers of stove bolts with the Government departments and scientific societies, to establish a national standard for stove bolts. The present practice of makers differs in head, thread and actual diameter and some modifications are necessary to obtain uniformity. To determine the requirements and preferences of consumers, a questionnaire has been sent out by the American Screw Co., Providence, R. I.

It is hoped that answers will be received promptly and information obtained which can be used in the promotion of uniformity.

JAPAN WAIVES STEEL DUTY

Many Products Exempted for Six Months—Some Inquiry for Galvanized Sheets, Wire and Nails

NEW YORK, Sept. 25.—The expected trade activity with Japan as a result of the earthquake is evidently still in process of development. While there are reports of some structural business having been awarded to European mills, probably Belgian, said to be quoting about $46 per ton, delivered, very little specific inquiry in this line has thus far appeared in the American market. Certain mills, however, are reported to have increased export prices on bars and shapes to $69 per ton, c.i.f. Japan, an advance of several dollars since the earthquake and a slight advance is also said by exporters to have been made on other products.

Inquiry for gas pipe is expected to develop before long but at present demand is almost entirely confined to requests for prices on galvanized sheets, 3 ft. x 6 ft., 13 sheets to the bundle (No. 30 gage) plain and corrugated (eight 3-in. corrugations to the sheet), of which there are probably total inquiries for 8000 to 9000 tons. Exporters also report requests for prices on a few hundred tons of No. 8 gage galvanized wire, wire nails and Nos. 30 and 31 gage black sheets. A few inquiries for copper have appeared and one Japanese export house reports an order for about 250 tons of electrolytic copper wire bars. Inquiries for bars and structural material are expected to take shape in about two weeks.

In view of the quotations now being made by American mills on the light gage galvanized sheets that are in demand for immediate use, it is considered doubtful by many exporters that much business will be placed in the United States. British sellers are said to be offering No. 30 gage galvanized sheets, plain, at $134.25 per ton, c.i.f. Japan, with corrugated (eight 3-in. corrugations, total width 2-ft. 2-in.) at $127.75 per ton, c.i.f. Japan, October delivery.

Practically all quotations are now being requested c.i.f. Kobe. The present active inquiry for galvanized sheets, it is pointed out, is at best only a temporary expedient to tide over the need, until the galvanizing plants, a large percentage of which are in the Osaka and Kobe districts, can absorb the unusual demand.

For the present, under an Imperial ordinance, notification of which was received by the Consul General of Japan, Sept. 20, galvanized sheets and a number of other iron and steel products are exempt from import duty, effective until March 31, 1924. In addition to a number of food products, medical supplies, slate, cement, bricks and clay tiles for building construction, the ordinance exempts from import duty iron bars or rods, including T's, angles, etc.; wire rods in coils; plates and sheets not coated with metals, nor exceeding 0.7 mm. thick or not otherwise mentioned in the tariff law; plates or sheets, tinned or galvanized; wire; pipes and tubes, not otherwise provided for in the tariff; iron nails, screws, bolts, nuts, washers and rivets; railroad construction material; posts and other materials for suspending electric lines; materials for construction of buildings, bridges, docks, etc., (shipbuilding materials excepted); cocks and valves, excluding those made of, or combined with precious metals; hinges, hathooks, and metal fittings for doors, windows, furniture, etc.; locks and keys; mechanics' tools, agricultural implements and parts thereof, not otherwise provided for; stoves and parts thereof; radiators; gas meters; water meters; ampere meters, voltmeters and wattmeters; telegraphic and telephone instruments and parts therefor; motor trucks and parts therefor; machinery of motor trucks; cranes; sewing machines, parts and accessories, excluding needles. The ordinance also exempts by one-half the import duty on automobiles other than motor trucks, but including automobile parts and motive machinery.

Japanese Tin Plate Order Increased

It is stated that the latest inquiry of the Nippon Oil Co., for 19,000 boxes of tin plate, which closed just prior to the earthquake was increased to 47,000 boxes and awarded to a New York branch of a Japanese export house, which placed it with a large independent export interest. Bids on the 120 sets of frogs asked for by the South Manchuria Railway Co., were opened at Dairen, Sept. 13 and award of 70 was made to Mitsui & Co., New York. Another opening of bids for 10 frogs will be made about Oct. 8 by this railroad.

In the rebuilding of the residential sections of the cities, which were visited by the disaster, says a report from Japan to the Department of Commerce, every economy will be practiced and the use of wood will be limited in every possible way. The city of Tokio, continues the report, for some time has contemplated the widening and straightening of its narrow, crooked streets, and many have already been designated for this improvement. This plan will no doubt be carried out in the reconstruction program and the widening of the streets will require quantities of paving blocks. It is reported, says the communication, that plans are being made to rebuild Tokio and Yokohama along modern lines, conforming with the construction of the Western World as closely as practicable. The possibilities along this line are somewhat limited, however, owing to the necessity of always keeping in mind the probability of a recurrence of earthquakes and designing the building accordingly, and the necessity of keeping the cost within certain limits, especially in the case of homes.

To Study Future of American Shipbuilding

Charged with the investigation of general conditions as affecting shipyards and ship repair plants over the entire country, a committee headed by J. Harry Mull, president and general manager of the Wm. Cramp & Sons Ship & Engine Building Co., last week established headquarters in the offices of the Atlantic Coast Shipbuilders' Association, 1600 Walnut Street, Philadelphia, and began a study of the varied problems of the industry with the view of formulating recommendations that will insure a permanent future for American shipbuilding.

The findings of the committee will be acted upon at the forthcoming American Marine Congress to be held in New York, Nov. 5-10, when representatives of all groups interested in water transportation will meet to consider the maritime problems in all of their various phases. The aim of the conference is to evolve a shipping program which will bring about a unity of purpose and coordination of effort throughout all industry, from the manufacturer who supplies the materials used in the construction of ships to the industrial groups whose products furnish the cargoes.

The cooperation of more than 200 American plants engaged in all branches of shipbuildings and marine repair work is sought in a communication which goes forward today from the shipyards committee pointing out the need for coordinated action and inviting the views of all shipyard executives as to subjects to be considered upon which definite recommendations can be formulated and placed before the American Marine Congress.

Associated with Mr. Mull on the shipyards committee are John G. Pew, president Sun Shipbuilding & Dry Dock Co., Chester, Pa.; H. G. Smith, vice-president Bethlehem Shipbuilding Corporation, Bethlehem, Pa.; E. P. Morse, president Morse Dry Dock & Repair Co., Brooklyn, N. Y.; and J. J. Tynan, general manager, Union Plant, Bethlehem Shipbuilding Corporation, San Francisco. The secretary of the committee is Clarence Samuel King, who is also secretary of the Atlantic Coast Shipbuilders' Association.

The Aetna Foundry & Machine Co., Warren, Ohio, has leased for a five-year period the plant in Sharon, Pa., of the Shenango Machine Co. The lease becomes effective Sept. 24. The plant will be used to produce blast furnace and steel mill castings. The foundry capacity of the plants in Sharon and Warren of the Aetna company is now equal to 800 tons per month.

ELECTRICAL ENGINEERS MEET

Steel Plant Problems Discussed at Buffalo—Electrified Foundry a Feature

BUFFALO, Sept. 25.—With an enrollment of about 400 at the close of the first day, the annual convention of the Association of Iron and Steel Electrical Engineers was put well under way today. Following a brief business session in the morning, in the Fillmore Room of the Hotel Statler, the exposition was formally opened shortly after 2 p. m. in the Broadway Auditorium. The afternoon technical session was devoted to standardization of equipment and reports of committees.

In the absence of R. B. Gerhardt, president of the association, the chair was filled in the morning and at the beginning of the afternoon sessions by W. S. Hall, chairman of the finance committee. At the first technical session, when announcement was made of the new officers, Mr. Hall introduced the new president, R. S. Shoemaker, as presiding officer for the remainder of the day.

At the close of the morning session, in a talk full of deep feeling, A. H. Swartz, special representative Westinghouse Electric & Mfg. Co., who has been continuously chairman of the convention committee since the association was founded in 1907, voiced his valedictory. He promised all the cooperation he could give to those who might succeed him but felt that he could carry the major responsibility no longer. Mr. Swartz, in company with the present treasurer, James Farrington, then of the La Belle Iron Works, E. Friedlander, W. T. Snyder and L. A. Palmer, the latter with Jones & Laughlin Steel Co., were founders of the association. It has now reached 1600 members and has representatives in every steel plant in the world.

New Officers

New officers were announced when the afternoon session began, as follows:

President, R. S. Shoemaker, superintendent of maintenance American Rolling Mill Co., Middletown, Ohio.

First vice-president, A. C. Cummins, electrical engineer Carnegie Steel Co., Duquesne, Pa.

Second vice-president, George Shaeffer, electrical engineer Carpenter Steel Co., Reading, Pa.

Treasurer, James Farrington,. electrical engineer Steubenville plant, Wheeling Steel Corporation.

Secretary, J. F. Kelly.

Directors: A. F. Jones, electrical engineer Champion Machine & Forging Co., Cleveland; Walter Kennedy, operating engineer Worth Steel Co., Claymont, Del.; E. F. Elliott, electrical engineer Sloss-Sheffield Steel & Iron Co., Birmingham; Henry Davis, electrical engineer Interstate Steel Co., Chicago, and F. W. Cramer, assistant to the electrical superintendent, Cambria plant of the Bethlehem Steel Corporation, Johnstown, Pa.

At the technical session reports were read from the electrical development committee of the safety committee, with special reference to automatic engine stops, and of the standardization committee. F. W. Cramer, who read this last report, made a strong plea for cooperation with the American Engineering Standards Committee, on the theory that electrical interests were largely ignored or sidetracked by that committee. He asked for the appointment by the steel companies of a strong, representative committee with power to carry the matter on. Another speaker told of listing 510 parts for one 5-hp. series-wound motor and emphasized the large investment tied up in some spare parts when many motors of many types and sizes were used. Another member suggested that, as contactors wear fastest, the first serious effort at standardization be centered there. Bolt hole spacing for motor bases is another item needing immediate action.

The Exposition

Nearly every booth on the main floor of the Auditorium was filled when the exposition opened and many of the exhibits were running. The one which, naturally, attracted most attention was the operating electrified foundry, which was organized by the Pittsburgh Electric Furnace Corporation and is being operated by the American Radiator Co., Buffalo. The Pittsburgh company furnished the Moore Rapid Lectromelt furnace, operating at 128 to 80 volts at full load and using 600 to 800 amperes of current. It is set on a brick floor with concrete pouring pit.

Commanding the pouring and casting floor is a 5-ton Shepard crane. There are 40 or more Truscon pressed steel flasks, two Osborn molding machines, a Worthington air compressor and a Hagan electric annealing oven in the group. The electrodes for the melting unit were supplied by the Acheson Graphite Co., Niagara Falls, N. Y.

To Cooperate with Electric Power Club

Tuesday's sessions covered bearings and centrifugal pumps in the morning and skip hoist and ore bridge control in the afternoon. The association plans to cooperate with the Electric Power Club in standardizing anti-friction bearings. The club has 16 standard motor ratings below 100 hp., with 13 shaft sizes and various pulley sizes. The association has 15 sizes of bearings to cover these. The difficulty lies with the motor builders in redesigning to fit standards, but their sacrifice is in name only, as they charge the customer for it anyway.

Production of Pig Iron, Steel Ingots and Castings in Canada

A heavy production of pig iron in Canada as well as of steel ingots and castings during August is reported by the Dominion Bureau of Statistics. Pig iron produced in August amounted to 92,587 long tons as compared with 81,647 tons in July. It is pointed out, however, that the increase was wholly in the quantity of basic pig iron produced by reporting firms for their own use, this representing 69 per cent of the gross output. The production of foundry iron was maintained while the output of malleable iron showed a decline of 70 per cent from July. For the eight months ending with August, the total production of all grades of pig iron amounted to 609,380 long tons, compared with 251,015 tons for the corresponding period last year and 413,448 tons for the first eight months of 1921. Ferroalloys produced during August were 2258 tons, while in July the output reached 2342 tons. During the month one furnace at Sault Ste. Marie, Ont., was banked and one additional furnace was blown in at Sydney, N. S., leaving the same number of furnaces in blast at the end of the month as during July. The following companies had furnaces in blast: The Algoma Steel Corporation, Sault Ste. Marie, Ont., three; the Steel Co. of Canada, Hamilton, Ont., two; the Canadian Furnace Co., Port Colborne, Ont., one, and the British Empire Steel Corporation, Sydney, N. S., three.

The August production of steel ingots and castings amounted to 105,056 long tons, an increase of 43 per cent over July when 73,532 tons were reported. Practically the whole of the increase was in basic open hearth steel ingots, which accounted for 100,817 tons. Steel castings accounted for 4239 tons, compared with 3810 tons in July.

Pennsylvania Railroad Issues New Tariff on Steel

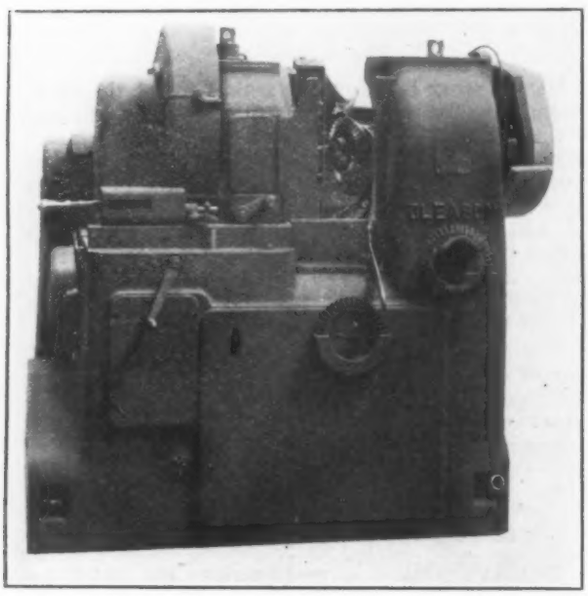
The Pennsylvania Railroad has issued a new tariff, advancing the Pittsburgh-Youngstown and Youngstown-Cleveland rates on steel products from 9½c. to 11c. and reestablishing the published through Pittsburgh-Cleveland rate of 21½c. For several years steel buyers have had the benefit of the combination of below local rates making the through rate to Cleveland 19c. The new rate becomes effective Oct. 7 and will affect a number of cities in the northern Ohio territory west of Youngstown.

NEW BEVEL-GEAR GENERATOR

Compact Machine for Mass Production, Either Singly or in Battery

Designed as single purpose equipment, a new bevel gear generator capable of producing high-grade bevel gears on a mass production basis faster than this has been done before has been put on the market by the Gleason Works, Rochester, N. Y. In appearance it is a radical departure in design from the Gleason bevel gear generators of the universal type, but the same basic principle of generating the tooth is used. The tooth contour is developed by relatively rolling the work and the tools together at a uniform pitch line velocity. The tools represent the adjacent teeth of a crown gear and, as they reciprocate, cut away the stock on the work and so develop correct tooth profiles.

Generating motion is obtained by means of a crown gear and segment, the generating roll being entirely



The New Gleason Bevel Gear Generator, Claimed to Turn Out Twice the Work Previously Obtained

on the work holding member. This arrangement has been developed into a simple and rigid form of design, which is very accurate, due to the few parts and fits involved. The index is of the notched plate type and is operated by the generating roll. The index plates are hardened and ground.

The tool carrying unit is mounted on an upright which, instead of swinging about a center, is given a lateral movement by a cam to feed the tools to the work. This permits the whole unit to be securely gibbed, with simple adjustments for taking up the wear.

The steel clapper box is integral with the slide and the steel tool holder is hardened and ground. The relief movement for the tools during the return stroke is mechanically operated and is positive in its action. The amount of movement necessary for the relief of the tools is exceedingly small because the swivel pins on which the clapper blocks swing are behind the cutting edges of the tools and almost in line with their travel. This small movement makes the machine quiet and steady in operation and, as the tool drive is arranged to have the effect of a draw cut, the connections being well ahead of the tools, high tool speeds can be maintained practically without vibration or noise, giving the work a smooth finish.

The tool carrying slides overrun the arms at both ends, so that a long run on any one job will not wear a depression in the bearing surfaces of either part. One large gib on each slide takes up the wear for all directions. The tools are the same as those used on the 11-in. and 18-in. Gleason generators.

Every point on the machine requiring lubrication is flood lubricated by a pump circulating system. There are two points for inspecting the oil flow, within easy sight of the operator. This is said to be the first time that every point requiring lubrication has been reached by one system. On this machine, besides all rotating bearings, the tool slides and all hand adjustments are reached by the central oiling system and even such points as the notches in the index plates and the friction surfaces on ratchet pawls are thoroughly oiled.

Considering the number of oil holes found on some machine tools, the advantage of having only one place to oil is readily apparent. On some modern tools it is not unusual to find from 70 to 130 points which require the operator's attention for lubrication and, of these, some are difficult to get at. Besides the loss of time shutting down the machine for oiling, considerable unnecessary upkeep costs have to be borne on account of an operator's failure to lubricate some vital point.

Chips are removed and both lubricating oil and cutting compound are replenished without stopping the machine or causing the operator any delay. The chips drop into a basket swivelled on trunnions. When full, this basket is tipped and the chips fall into a second basket at a lower level and remain until the service man removes them, which is done by lifting out the basket complete and dumping.

The machine is started by means of a lever and the control is sensitive. If necessary, the tools can be "inched" along very small distances. When the machine reaches the correct position for reloading, an automatic stop operates to shut down the machine by throwing off the disk friction clutch.

To permit two or more of the machines to be set up in battery, the surfaces where they come together are planed parallel, so that the joints are always true and tight. Repair work or replacement of parts on any portion of these machines, when set up in battery, can be made without moving the machine.

As arranged for motor drive, the 3-hp. motor is located on the back of the machine and belt-connected to the main drive pulley. This pulley has a very heavy rim and, running continuously, is in effect a flywheel. Power is transmitted to the main shaft of the machine by a disk friction clutch. When the automatic stop releases this friction clutch, the pulley runs free and, as there is but slight momentum in the machine, it stops without appreciable coast. In starting, too, there is no lost time in getting under way, as the momentum in the constantly revolving pulley brings the machine up to full speed as soon as the clutch is engaged.

The work head, designed for differential gears and pinions, can be arranged to handle any of these parts having a pitch angle between 61 deg. and 29 deg. minimum. Each gear or pinion will require a crown gear and segment corresponding to its pitch angle and an index plate for the correct number of teeth. For greater pitch angles than these, a separate complete work head is needed and the same is true for pinions of a lesser angle. In both these cases, a variety of gears or pinions can be cut if proper segments, crown gears or index plates are provided.

The machine is very compact, the floor space of the belt driven equipment being 4 ft. 6 in. x 3 ft. 8 in. The 3 ft. 8 in. dimension is slightly increased when the machine is motor driven, the exact amount depending on the motor used. When arranged in battery formation, a spacer is used to join the machines together if the pitch angle of the gear to be cut is greater than 35 deg.

The machine can be arranged to cut gears falling within the following specifications:

Cone distance: greatest, 4½ in.; least, 2 in.
Pitch angle: greatest, 75 deg. 58 min.; least, 14 deg. 2 min.
Extreme ratio for right angle bevels, 4 to 1.
Largest gear of 4 to 1 ratio, 8¾ in.
Largest gear of 2 to 1 ratio, 8 in.
Largest gear of 1 to 1 ratio, 6¾ in.
Largest diametral pitch, 4 D.P.
Longest face, 1¼ in.
Time for generating one tooth, 4 to 30 sec.
One cutter speed is supplied and this can be any speed between 300 and 500 strokes per minute.

One of these machines has been operating continuously 24 hr. per day for several months on production work and the quantity turned out has been twice what had been previously accomplished on the universal type bevel-gear generator. This output was obtained without any sacrifice in the quality of the work.

GERMAN PRICES

Quotations of Major Products on the Basis of the Past Six Weeks

(By Radiogram)

BERLIN, GERMANY, Sept. 25.—Foundry pig iron is quotable at 122s. 6d. per ton, the figure at which it stood in early September. With one pound sterling equivalent to $4.56, this price corresponds to about $27.90. Prior to Aug. 13, when iron was quoted in paper marks, price advances did not keep pace with the fall in exchange, and since prices have varied automatically, according to the exchange rates between the mark and the pound sterling. The last quotation on the paper mark basis was an equivalent to about $12 per gross ton.

Steel ingots are quoted at 165.90 gold marks per gross ton, which on a gold parity basis would put ingots much higher than the former basis of quotation, the last such being an equivalent of $14.60. The quotation for steel bars is 240 gold marks and for thin sheets 400.10 gold marks.

BELGIAN MARKET QUIET

Exchange Fluctuation Affects Business—Prices Fairly Steady Despite Keen Competition From Lorraine

BRUSSELS, BELGIUM, Sept. 13.—Activity is moderate because of the hesitation on the part of buyers as a result of the fluctuations of the pound sterling. When the pound is decreasing buyers refuse to pay the prices asked and no concession is made by the sellers, who await a rise in the exchange.

Business has been very quiet and it is beginning to be realized that the fluctuations of exchange have a direct effect upon the industrial and commercial life of the country. The price tendency is firm, for some of the larger companies, well booked ahead, refuse to make any reduction. Those with smaller tonnages on their books, however, are concluding orders at about 750 fr. for bars (Lorraine and Luxemburg prices), while others will not accept less than 775 to 800 fr., or £8 2s. 6d. Buyers have been offering about 725 fr., or £7 15s. to £7 17s. 6d. Like the French market, the Belgian market is influenced by the new turn taken in the Ruhr discussion.

Coke.—The price for metallurgical coke is about the same as in July and August, which were 203.60 fr. and 203.50 fr. per metric ton, respectively.

Pig Iron.—The market is unchanged, apart from some weakness as a result of offerings by Lorraine and Luxemburg, which in some cases are as low as 435 Belgian francs. There are very few transactions in basic Bessemer, most of the furnaces utilizing their production in their own steel works. The following are quoted either delivered or f.o.b. Antwerp: Casting No. 3, 455 to 465 fr.; ordinary basic, 450 to 455 fr. Luxemburg prices are: Casting No. 3, f.o.b. Antwerp, 450 to 455 fr., and Lorraine, 445 to 455 fr.

Semi-Finished Steel.—Prices are easier as a result of Lorraine and Luxemburg competition, and the improvement in exchange. Few transactions are noted. Basic material is quoted per metric ton as follows:

	Belgian, at Works, Fr.	Lorraine, f.o.b. Antwerp, Fr.	Luxemburg, f.o.b. Antwerp, Fr.
Ingots	550 to 560	.....	.....
Blooms	590 to 600	610 to 615	600 to 605
Billets	610 to 620	625 to 635	610 to 615
Largets	630 to 640	640 to 645	625 to 630

Finished Material.—The influence of exchange is felt keenly in this market, demand being heavy when the pound sterling is rising and vanishing when a decline is noted. Works are so well supplied with orders, however, that in spite of Lorraine and Luxemburg competition prices are firmly maintained. Transactions are still on a base of 750 fr. and higher, while the pound sterling was at 94.50 fr. on Sept. 12. Beams are quoted f.o.b. Antwerp, at £7 10s., rods at 925 to 950 fr. Lorraine makers quote 750 fr. minimum f.o.b. Antwerp, with 20 to 25 fr. increase for small shapes. Beams are quoted at £7 10s. Luxemburg makers have the same quotations. Three Belgian plants, Ougrée, Cockeril and La Providence, are furnishing a total of 5000 tons of rails to Japan.

Sheets.—The market is firm, despite Lorraine competition, and the reserve shown by buyers who evidently expect lower prices. Heavy sheets are now 775 fr. and medium sheets on a £10 base. Light, polished and galvanized sheets are firmer. Lorraine mills quote f.o.b. Antwerp: 5 mm. and heavier, 780 fr.; 3 mm., 850 fr. Offers have also been made of 5 mm. sheets at £8 5s. Open-hearth grade is worth 5s. more. Bessemer sheets, 5 mm. thick, are quoted at 775 to 800 fr.; 3 mm., 850 fr.; 2 mm., 900 to 925 fr. Galvanized sheets are quoted at: 1 mm., 2000 to 2025 fr.; 8/10 mm., 2150 to 2175 fr.; galvanized, 5/10 mm., 2450 to 2475 fr., and boiler sheets, 850 to 875 fr.

Old Material.—The market is completely disorganized as a result of arrivals of German reparation scrap sold at low prices by the Government. Consequently, the tendency is very weak, with prices uncertain and nominal.

Carburization of Steel

At the suggestion of a group of metallurgists of the automobile industry, the Bureau of Standards has taken up the investigation of the carburization of steel, a problem of great importance in this industry. The specific purpose of the investgiation will be to determine whether or not the initial quality of a steel influences to any marked extent the results obtained in carburizing practice as has been claimed by some commercial metallurgists. Specimens of "normal" steels, that is, steels which in the hands of these metallurgists prove to be entirely satisfactory, and of "abnormal" steels, those which gave results of a decidedly different character when subjected to the same carburizing process, have been secured; and the preliminary work of cutting the samples, making examinations of the structure, etc., is now under way.

Alabama Furnaces Blown Out

BIRMINGHAM, ALA., Sept. 25.—The Sloss-Sheffield Steel & Iron Co. tonight blows out No. 2 City and Florence blast furnaces, leaving two North Birmingham and one Sheffield in operation. The policy of the furnace interests in the Birmingham district is to cut down production of high cost iron until the demand improves.

Writing on the perpetual inventory of raw and finished stock William R. Basset, president Miller, Franklin, Basset & Co., Inc., New York, says that an excellent perpetual appraisal record consists of one card, or loose leaf sheet for each machine. These can be grouped into departments. On the card is recorded the first cost, the freight, the cost of installing, the cost of major repairs, the depreciation rate and amount, and the present value. If the machine is moved to another department, that fact is noted on the card, and the card is transferred in the file to the new department.

This week the Newton Steel Co., Youngstown, operating a sheet mill plant at Newton Falls, in Trumbull County, Ohio, expected to place in commission three new mills which have been under construction for several months, giving it a total complement of 20. Working at capacity, these mills have a monthly output of 11,000 tons of sheets, or 130,000 tons yearly. Of its production, fully 90 per cent is devoted to full finished stock for the metal furniture and automobile body industries.

Iron and Steel Markets

AN ENDURANCE CONTEST

Necessity Buying Being Held Back for Price Advantage

Curtailment in Sheet and Bar Mills—Sustained Structural Demand

Market developments in steel throw in relief an endurance contest between consumer and producer. The one finds needs growing but views a waiting policy as wholly to his advantage, having an eye to price concession and no fear of securing quantity or delivery when he orders. The other sees no buying volume awaiting release on a price reduction, but with nearly five months of substantially unchanged prices, and advancing costs meanwhile, looks for necessity purchases in the next few weeks sufficient to maintain today's price levels. A factor is that large consumers long out of the market for regular requirements do not find it easy to adjust themselves to steel at prices as much as $10 a ton higher than they are paying on present shipments.

With the Steel Corporation and with some of the independents, bookings in the last week have improved, but the general experience is that September so far is no better than August. Production activity has been curtailed to the extent that some sheet and bar mills have shut down.

In pig iron weakness has become more pronounced. In the South the price has declined $1, with $21, Birmingham, as the new ruling quotation. Three blast furnaces in Alabama have been blown out this week on account of unsatisfactory market conditions. Prices have been marked down $1 at Chicago, with concessions of 50c. to $1 not uncommon in the East and Central West. A Nova Scotia producer was a factor in a transaction in Connecticut, taking an order in competition with eastern Pennsylvania furnaces.

In the face of a break in plate prices in the East from 2.50c. to 2.40c. per lb., Pittsburgh basis, plate business looms large in the West. For oil tanks, 14,000 tons was bought in Chicago; Portland, Ore., wants 13,000 tons for a pipe line and Eastern mills are quoting on 5000 tons of tank work on the Pacific Coast. With a so-called conference rate of 40c. per 100 lb., Eastern mills are expected to give a Pacific port price of 3c., equivalent to 2.60c., Philadelphia.

Including tank work, fabricated steel bookings total 23,000 tons. These and new inquiries calling for 17,000 tons show no falling off in the structural field.

Railroad equipment inquiries are chiefly for passenger cars. China is in the market for 50 flat cars.

The Baltimore & Ohio distributed 30,000 tons of rails to the Bethlehem, Inland and United States Steel Corporation mills.

Container manufacturers are considering tin plate requirements for the first quarter and first half of next year. For the remainder of this year the mill problem is almost solely a matter of deliveries. The United States is expected to be a large factor in the world's markets next year.

Increased specifications have been received from the farm implement manufacturers. Though not large, they are significant as being the first change for the better in months. Agricultural machinery makers are operating at not more than 40 to 50 per cent of capacity.

Lake shipyards are figuring on two car ferries for the Canadian National Railways, each requiring 2600 tons of plates and shapes.

Most wire mills have caught up sufficiently on their orders to offer prompt shipments.

The market is still a buyer's in bolts, nuts, rivets and also hot rolled flats. Black sheets remain unsteady with 3.75c., Pittsburgh basis, more commonly quoted.

The prospect of resumption of industrial operations in the Ruhr is viewed with much interest by iron and steel manufacturers in the United States, who expect that in time the products of Europe will compete with those of the United States on both the Atlantic and Pacific Coast.

Reductions in both foundry and steel making irons bring THE IRON AGE pig iron composite price to the lowest point in 14 months, or to $24.37, against $25.04 last week and $32.54 a year ago.

THE IRON AGE composite price for finished steel remains at 2.775c. per lb., the level reached by a slight reduction ten weeks ago.

Pittsburgh

September Proves Disappointing in Steel Buying—Pig Iron Prices Lower

PITTSBURGH, Sept. 25.—September has been a disappointment in new business in steel. While some companies say the month was as good and some that it even slightly bettered the August record, the most common experience has been that the total bookings were below those of last month. While the suggestion is frequently made that fundamental conditions are sound and conducive to good business, consumers appear to be guided by the psychology of the situation rather than by rates for money, buying power of a country or by the fact that there is no apparent diminution in consumption. American industry is essentially speculative to some degree and the fact that there is nothing in sight to suggest higher prices in the near future and that there is a possibility of recessions tends to keep down purchases to known requirements.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month, and one year previous

For Early Delivery

Pig Iron, Per Gross Ton:	Sept. 25, 1923	Sept. 18, 1923	Aug. 28, 1923	Sept. 26, 1922
No. 2X, Philadelphia‡	*$25.76*	$26.26	$26.26	$34.26
No. 2, Valley furnace†	*24.50*	25.00	25.00	33.00
No. 2 Southern, Cin'ti†	*25.05*	26.05	27.55	31.05
No. 2, Birmingham, Ala.†	*21.00*	22.00	24.00	27.00
No. 2 foundry, Chicago*	*26.00*	27.00	27.00	32.00
Basic, del'd, eastern Pa.	25.00	25.00	25.00	29.00
Basic, Valley furnace	*24.50*	25.00	25.00	34.00
Valley Bessemer, del P'gh.	28.26	28.26	28.26	35.77
Malleable, Chicago*	*26.00*	27.00	27.00	32.00
Malleable, Valley	24.50	24.50	24.50	34.00
Gray forge, Pittsburgh	25.76	25.76	25.76	34.27
L. S. charcoal, Chicago	32.15	32.15	32.15	36.15
Ferromanganese, furnace	110.00	110.00	117.50	67.50
Rails, Billets, Etc., Per Gross Ton:				
O.-h. rails, heavy, at mill	$43.00	$43.00	$43.00	$40.00
Bess. billets, Pittsburgh	*40.00*	42.50	42.50	40.00
O.-h. billets, Pittsburgh	*40.00*	42.50	42.50	40.00
O.-h. sheet bars, P'gh.	*40.00*	42.50	42.50	40.00
Forging billets, base, P'gh.	47.50	47.50	47.50	45.00
O.-h. billets, Phila.	47.67	47.67	47.67	45.17
Wire rods, Pittsburgh	51.00	51.00	51.00	45.00
	Cents	Cents	Cents	Cents
Skelp, gr. steel, P'gh, lb.	2.40	2.40	2.40	2.00
Light rails at mill	2.15	2.15	2.25	2.25
Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Iron bars, Philadelphia	2.67	2.67	2.67	2.475
Iron bars, Chicago	*2.35*	2.40	2.40	2.25
Steel bars, Pittsburgh	2.40	2.40	2.40	2.00
Steel bars, Chicago	2.50	2.50	2.60	2.10
Steel bars, New York	2.74	2.74	2.74	2.44
Tank plates, Pittsburgh	2.50	2.50	2.50	2.25
Tank plates, Chicago	2.60	2.60	2.80	2.30
Tank plates, New York	2.84	2.84	2.84	2.49
Beams, Pittsburgh	2.50	2.50	2.50	2.60
Beams, Chicago	2.60	2.60	2.70	2.20
Beams, New York	2.84	2.84	2.84	2.44
Steel hoops, Pittsburgh	3.15	3.15	3.15	2.75

*The average switching charge for delivery to foundries in the Chicago district is 61c. per ton.
†Silicon 1.75 to 2.25. ‡Silicon 2.25 to 2.75.

Sheets, Nails and Wire, *Per Lb. to Large Buyers:*	Sept. 25, 1923 Cents	Sept. 18, 1923 Cents	Aug. 28, 1923 Cents	Sept. 26, 1922 Cents
Sheets, black, No. 28, P'gh.	3.75	3.75	3.75	3.35
Sheets, galv., No. 28, P'gh.	5.00	5.00	5.00	4.35
Sheets, blue an'l'd, 9 & 10	3.00	3.00	3.00	2.50
Wire nails, Pittsburgh	3.00	3.00	3.00	2.70
Plain wire, Pittsburgh	2.75	2.75	2.75	2.45
Barbed wire, galv., P'gh.	3.80	3.80	3.80	3.35
Tin plate, 100-lb. box, P'gh.	$5.50	$5.50	$5.50	$4.75
Old Material, Per Gross Ton:				
Carwheels, Chicago	*$19.50*	$20.00	$19.50	$24.50
Carwheels, Philadelphia	21.00	21.00	21.00	23.00
Heavy steel scrap, P'gh.	*17.50*	18.00	18.00	21.50
Heavy steel scrap, Phila.	16.50	16.50	16.50	18.00
Heavy steel scrap, Ch'go.	*16.00*	16.25	16.00	18.50
No. 1 cast, Pittsburgh	*21.00*	22.00	21.50	24.00
No. 1 cast, Philadelphia	*21.00*	21.50	21.50	23.00
No. 1 cast, Ch'go (net ton)	*19.50*	20.00	18.50	21.00
No. 1 RR. wrot. Phila.	*19.00*	20.00	18.00	22.00
No. 1 RR. wrot. Ch'go (net)	*15.00*	15.50	15.00	17.50
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	$4.25	$4.25	$4.75	$12.00
Foundry coke, prompt	*5.00*	5.25	5.50	13.00
Metals,				
Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Lake copper, New York	*13.87½*	14.00	14.25	14.25
Electrolytic copper, refinery	*13.25*	13.37½	13.75	13.75
Zinc, St. Louis	*6.42½*	6.45	6.42½	6.87½
Zinc, New York	*6.77½*	6.80	6.77½	7.22½
Lead, St. Louis	*6.75*	6.80	6.65	6.25
Lead, New York	*7.10*	7.12½	6.75	6.50
Tin (Straits), New York	*42.25*	41.50	40.75	32.50
Antimony (Asiatic), N. Y.	7.50	7.50	7.50	6.75

The prices in the above table are for domestic delivery and do not necessarily apply to export business.

Composite Price Sept. 25, 1923, Finished Steel, 2.775c. Per Lb.

Based on prices of steel bars, beams, tank plates, plain wire, open-hearth rails, black pipe and black sheets — These products constitute 88 per cent of the United States output of finished steel

Sept. 18, 1923,	2.775c.
Aug. 28, 1923,	2.775c.
Sept. 26, 1922,	2.433c.
10-year pre-war average,	1.689c.

Composite Price Sept. 25, 1923, Pig Iron, $24.37 Per Gross Ton

Based on average of basic and foundry irons, the basic being Valley quotation, the foundry an average of Chicago, Philadelphia and Birmingham

Sept. 18, 1923,	$25.04
Aug. 28, 1923,	25.38
Sept. 26, 1922,	33.54
10-year pre-war average,	15.72

This tendency is emphasized by the fact that the railroads are functioning with unusual efficiency and steel production is at a rate that is suggestive of ample supplies.

News that sheet bars have declined in prices has tended to make sheet buyers even more cautious than they were recently, and a price of 3.75c. base on black sheets is somewhat more common than it was recently, notwithstanding that some of the smaller producers find the margin between semi-finished and finished steel prices so slim that they are planning to shut down.

The market still is favorable to buyers on bolts, nuts and rivets, and also on hot-rolled flats. There are also intimations that the Chicago price of 3c., Pittsburgh, on cold-finished steel bars is being met by Eastern producers, notably in the Detroit district. It is impossible to detect any easing of local mill prices on the other products, although reports of concessions are fairly frequent.

Fresh weakness has developed in foundry pig iron on comparatively limited sales. A sanitary ware manufacturer was able to develop a price of $24.50, Valley furnace, for No. 2, and it is understood that an even lower price was named against the Westinghouse business.

There has been a general recession of 50c. a ton in the steel works grade of scrap and the market is dull even at the new levels. The coal and coke market is even weaker than it was a week ago. Furnace coke is freely offered at $4.25, and good foundry coke as low as $5. The supply of coal so far exceeds demand that prices are largely of buyers' making.

Pig Iron.—The fact that production of pig iron still is running ahead of consumption and that producers are adding to their stocks is again telling on prices. The largest individual transaction of the week involved about 2000 tons of foundry grade to the Standard Sanitary Mfg. Co. at $24.50, Valley furnace, or Valley furnace basis for the base grade. This sale represents a drop of 50c. a ton from last week's quotation, but apparently does not represent the bottom of the market, as a lower price is said to have been quoted on the Westinghouse inquiry amounting close to 7000 tons for its local and Cleveland foundry. It has been an ex-

tremely quiet week in the steel-making grades. We hear of only small lot sales of Bessemer and there has been an utter dearth of sales of basic grade. The common asking price on the latter is $25, Valley furnace, but this price was not interesting to a Sharon, Pa., melter who recently inquired for 1000 tons, presumably because there have been quotations as low as $24.50. In the absence of sales, but based on offerings, the market is now quotable at $24.50 to $25. A Pittsburgh melter recently bought 100 tons low phosphorus iron at $30, Valley furnace.

We quote Valley furnace, the freight rate for delivery to the Cleveland or Pittsburgh district being $1.76 per gross ton:

Basic	$24.50 to $25.00
Bessemer	26.50
Gray forge	24.00
No. 2 foundry	24.50
No. 3 foundry	24.00
Malleable	24.50
Low phosphorus, copper free	30.00

Ferroalloys.—The present market on ferromanganese is being made by resale offerings of British material. Importers bought some of this alloy for their own accounts and failed to move all of it before the demand slumped. Now they are pressing it for sale and recently moved about 300 tons at between $108 and $109, seaboard. It is said that about 1000 tons still is hanging over the market and with the demand limited, efforts of producers to obtain more are unavailing. Recent sales into the Chicago district now are said to have figured back to $108, Eastern Atlantic seaboard. Interest on the part of consumers is low in the other ferroalloys and prices are merely nominal. Prices are given on page 863.

Semi-Finished Steel.—Local mills disclaim having gone below $42.50, Pittsburgh or Youngstown, on billets, slabs and sheet bars, but such sales as have been made at that figure lately for the most part either have been of tonnages which were required very promptly or in an adjustment of third quarter contracts at higher prices against which buyers did not specify fully. A recent contract for 6000 tons of billets and slabs for fourth quarter to be shipped in equal monthly quantities at $42.50, Pittsburgh, is believed to have been possible because the buyer had not taken much of the tonnage bought for delivery in the second and third quarters. A Pittsburgh district sheet maker recently closed for a round tonnage of sheet bars at $41.50, Pittsburgh. Forging billets still are quoted at $47.50, base, but only small sales are being made. Skelp is very dull and rods continue in light demand, except for some export inquiry, chiefly from Japan. It is claimed that base price on rods is well maintained, but it is admitted also, that the extra for coarse rods is not always obtained. Prices are given on page 863.

Wire Products.—There is a fair run of orders in the commoner products like nails and manufacturers' wire, but they are almost entirely for nearby delivery, as buyers are impressed by the favorable transportation and production conditions and are not yet showing much interest in their fourth quarter requirements. A few contracts for nails and wire for that period have been entered, but as a general rule buyers are inclined to pursue a conservative policy. We note no shading of regular prices by mills in this territory. It is asserted that present prices are so close to costs that there is nothing to give away and there is considerable doubt that price concessions would stimulate buying. On an average, mills in this district have about a month's business on their books. Prices are given on page 862.

Steel Rails.—While the larger producers of light rails, rolling them from billets, still claim to be holding firmly to the 2.25c. base, there are some makers who have recently taken business at 2.15c. base. General demand is slightly more active than it was recently, but there are few sizable inquiries and competition from rerolled rails still is fairly sharp.

We quote light rails rolled from new steel at 2.15c. to 2.25c. base (25-lb. to 45-lb.); those rolled from old rails, 1.90c. to 2c. base (12-lb. to 45-lb.), f.o.b mill; standard rails, $43 per gross ton mill, for Bessemer and open-hearth sections.

Tubular Goods.—Pressure for shipments of standard pipe in both wrought iron and steel still is heavy, and makers of steel pipe of this classification still report their inability to fully satisfy their customers. Pressure for shipments of oil country goods is relatively light and the new demand fully reflects the unsettled crude oil market. Pennsylvania crude oil was cut 25c. per barrel late last week to $2.50 per barrel, as against $4 last spring. Oversupply of crude oil is due chiefly to the heavy production in California and while late reports from the southern portion of that State indicate a falling off in production, the more general belief is that some time will elapse before the general oil supply situation is corrected to a point where fresh drilling and development work will be sufficiently active to increase the demand for tubular goods. Several inquiries for small tonnages of line pipe are current. There is one inquiry for 25 miles of 10-in. pipe for South America. New business in boiler tubes is very light and it is reported that an extra 5 per cent is being given by some makers of charcoal iron tubes. Most makers of seamless tubes still have a fair backlog of business. Discounts are given on page 862.

Cold-Finished Steel Bars and Shafting.—Consumers are buying against only their known requirements and with forward buying very largely lacking, the market is best described as quiet. Makers in this district all are holding firmly to the 3.25c. base and deny that they are meeting lower prices out of Chicago even in competitive territory. Ground shafting still is quoted at 2.65c. base, f.o.b. mill, for carload lots.

Hot-Rolled Flats.—Few of the independent makers of these products are at all heavily committed and while such fourth quarter business as has been booked carries the price of 3.15c., base, there is some doubt whether all makers are rigidly adhering to that figure. Wider sizes of strips still can be bought at 3c., base, and competition for rim stock business keeps the market in buyers' favor. Cooperage demands suffer to some extent by the unsettled market in oil, which is cutting down the demand for wooden oil barrels. Prices are given on page 862.

Cold-Rolled Strips.—Real activity is lacking, but so far there has not been any tendency to seek orders at the expense of prices and this product still is quotable at 5c., base, Pittsburgh.

Bolts, Nuts and Rivets.—Larger producers of bolts and nuts do not appear to be meeting the lower prices, which are being named by the smaller makers, whose need of business apparently is pretty urgent. This also is true in rivets, the producers of which, representing the larger part of the country's output, claim that they are not going below 65 and 10 per cent off list on small rivets nor below $3, base, per 100 lb. on heavy rivets. There is some shading of these prices, but it is chiefly for early delivery orders and is not being done on fourth quarter contracts. Prices and discounts are given on page 862.

Track Fastenings.—Railroads are expected to follow up recent rail purchases with orders for the fastenings and already a good many sizable inquiries are current for large spikes. There are no intimations of lower prices than have been quoted for some time on large spikes. There is some irregularity in small spikes, however, as demand is not particularly brisk and some makers, especially in the East, want orders badly enough to cut prices. Prices are given on page 862.

Structural Material.—Demands upon local mills run chiefly to small tonnages for early delivery and fall far short of making good shipment against old orders. There seems to be no important deviation from the regular market price of 2.50c. base for large structural shapes. Prices are given on page 862.

Plates.—Mills in this territory are holding firmly to 2.50c. base, although new business is considerably smaller than shipments and several of the independent producers need orders to maintain present operating schedules. Prices are given on page 862.

Sheets.—This market was slow and not overly steady. Buyers are encouraged to defer purchases by the fact that a good many of the smaller producers need business and that some of the larger units lack backlogs, particularly in black sheets. Development of

lower prices for sheet bars does not suggest advances in the near future in the finished product, and the tendency of most consumers is to let their inventories run down. Shading of quoted prices is more common in black sheets than in the other finishes. It is estimated that Japanese requirements will run between 20,000 and 30,000 tons, but the Japanese want No. 30½ and No. 31 gage tin mill gages and American producers are trying to get them to take No. 30 gage material, which is the limit of sheet mill economical practice. Prices are given on page 862.

Tin Plate.—Already there is interest on the part of large container manufacturers in requirements for the first quarter and first half of next year. Business for the remainder of this year has been largely placed and now is merely a matter of deliveries. This year has been a very heavy one in the matter of tin plate consumption, although export business has been much smaller than it was last year. The can companies are figuring on a very heavy pack of perishable foods next year and tin plate manufacturers also expect to be larger factors in the world's markets than they have been this year. All makers still are quoting $5.50 per base box, Pittsburgh.

Iron and Steel Bars.—All makers of steel bars in this and nearby districts are holding firmly to 2.40c., base, although current orders are moderate and specifications on contracts show some decrease in keeping with a slower market in bar products. Makers of iron bars also are maintaining recent prices.

We quote soft steel bars, rolled from billets, at 2.40c. base; bars for cold-finishing of screw stock analysis, $3 per ton over base; reinforcing bars, rolled from billets, 2.40c. base; refined iron bars, 3.25c. base, in carload lots or more, f.o.b. Pittsburgh.

Old Material.—Steel works grades generally have declined about 50c. a ton since a week ago and we now carry heavy melting grade at $17.50 to $18. The lower price was all that a local mill would allow on shipments made without an order and provides the best guide as to where the local market is on this grade, since if more could have been obtained elsewhere, the material would have been reconsigned. As a general rule, mills in this district not only are out of the market, but those which are not closed to shipments by embargoes are watching that there are no overshipments on orders. The market is a disappointment to many dealers, who shared the fairly common idea of a few weeks ago that September would be productive of increased steel orders, well maintained steel works operations and a buying movement in scrap. Some went "long" of the market on that belief and now have much trouble in finding an outlet for purchases except at a loss. The market is slightly stronger on turnings, which have sold up to $14 and on cast iron borings, price of which has advanced 50c. a ton since last week. Demand for foundry grades has not been sufficient to hold the market up to its recent levels.

We quote for delivery to consumers' mill in the Pittsburgh and other districts taking the Pittsburgh freight rate as follows:

	Per Gross Ton
Heavy melting steel	$17.50 to $18.00
No. 1 cast, cupola size	21.50 to 22.00
Rails for rolling, Newark and Cambridge, Ohio; Cumberland, Md.; Huntington, W. Va., and Franklin, Pa.	18.50 to 19.50
Compressed sheet steel	15.50 to 16.00
Bundles, sheets, sides and ends	14.50 to 15.00
Railroad knuckles and couplers	22.00 to 22.50
Railroad coil and leaf springs	22.00 to 22.50
Low phosphorus bloom and billet ends	24.00 to 24.50
Low phosphorus plate and other material	23.00 to 23.50
Railroad malleable	21.00 to 21.50
Steel car axles	20.50 to 21.00
Cast iron wheels	18.50 to 19.00
Rolled steel wheels	22.00 to 22.50
Machine shop turnings	13.00 to 14.00
Sheet bar crops	20.00 to 20.50
Heavy steel axle turnings	15.00 to 15.50
Short shoveling turnings	14.50 to 15.00
Heavy breakable cast	19.00 to 19.50
Stove plate	15.50 to 16.00
Cast iron borings	16.00 to 16.50
No. 1 railroad wrought	14.50 to 15.00
No. 2 railroad wrought	17.50 to 18.00

Coke and Coal.—This week a price of $4.25 per net ton at oven is the top of the market and as offerings are heavy at that figure, it is possible that before another week goes by the price may be $4 flat, thus setting up a new low market for the year. Demand is very limited for both spot and future shipments because of the continued uncertain outlook for pig iron. Only a small portion of the Connellsville production is yet under contract for the fourth quarter because blast furnace operators are so doubtful about keeping their furnaces in blast. On such recent fourth quarter business as was done, $4.75 was the price, but that is now merely an asking price and it is believed that $4.50 could be done. Spot foundry coke is quotable from $5 to $5.50 and offerings are large in relation to demand. Practically no market exists for coal and very low prices prevail, particularly on slack, which is being pressed for sale and is selling as low as $1 per ton for steam and $1.50 for gas. Mine run steam coal is quotable from $1.85 to $2 and mine run gas and coking coal from $2 to $2.25. These prices, however, are not very firm.

Krupp Interests Said to Be Negotiating for Mexican Company

WASHINGTON, Sept. 25.—While denials have been made by officials of the Monterey Iron & Steel Co., reports from other sources persist that the Krupp works in Germany is negotiating for the purchase of the Mexican company's plant particularly for the purpose of obtaining control of its mountain, Cerro de Hierro (hill of iron), in the State of Durango, located several hundred miles from the company's steel works. It is claimed that the negotiations are being conducted by a Mr. Hehny, representing the Krupp works, who is now in Mexico. The fact that Germany is greatly in need of raw resources, especially ore, and the problem she faces because of this by reason both of a shortage of ore and the low value of the mark which makes purchase of foreign ore a difficult financial matter, has given credence to the report of the negotiations.

It is claimed that Mr. Hehny has been visiting all of the stockholders of the Monterey Iron & Steel Co. in an effort to buy the stock at par. The corporation has not been paying dividends. The iron mountain is said to contain tremendous quantities of ore. With improved transportation facilities together with modern mining and other equipment, it is claimed that the ore deposits would be of great value to the Krupp people, who, it is claimed, would either convert the ore into pig iron or ingots and ship the manufactured product to their plant in Germany for finishing into rolled steel.

The coal problem will be the major topic of the meeting at Rochester, N. Y., Oct. 12 and 13, of the executive board of the American Engineering Council of the Federated American Engineering Societies. The federation's committee on coal storage has been conducting a study in cooperation with 107 local committees of engineers all over the country. Its report is expected to view the storage of coal as a practice which should be adopted on no basis other than that of a sound economic one. The final report, it is stated, will deal with many other aspects of the storage problem, including the technique of coal storage considered from the chemical standpoint and from the materials handling standpoint.

The Sullivan Machinery Co., Michigan City, Ind., maker of mine machinery, has opened its new plant in that city and has moved all machinery from the old Chicago plant at 2824 West Lake Street to the new location. The company was organized at Claremont, N. H., in 1869 and 23 years later was merged with the Diamond Prospecting Co., an Illinois corporation. In 1902 the M. C. Bullock Co., Chicago, was purchased and became the Western manufacturing unit. The principal manufacturing plant is at Claremont, where about 1500 men are employed. Among the Sullivan company's products are air compressors, undercutting machines, rock drills and prospecting machinery. The management remains unchanged with Frederick K. Copeland, Chicago, president.

Chicago

Round Tonnage for Tanks—Pig Iron Prices Decline One Dollar

CHICAGO, Sept. 25—The placing of 14,000 tons of tank work marks the first buying by oil interests in this market for several weeks. Further large additions to storage capacity would seem to be imperative unless the present overproduction of crude oil is curtailed through a suspension of drilling and pumping. At the moment, however, there are few tank inquiries actually active.

Railroad car buying, one of the chief sources of heavy tonnage business for Western mills, remains quiescent. While there are rumors of a possible revival in equipment purchases this fall, it would appear that the wish is the father of the thought, as no definite prospects have been uncovered. So far as railroad carbuilders can discover, there is not even any active engineering work in car design such as customarily precedes the issuance of inquiries. A certain amount of car repair work is being undertaken, but probably no more than has been carried on throughout the summer. In fact, inquiries for repairs received by car builders have been notably few.

Generally speaking, the steel market shows no material change. Shipments from mills continue to exceed new business and consumers still follow a hand to mouth buying policy. Prices of plates, shapes and soft steel bars remain unchanged and firm. Bar iron is still weak and has declined to 2.35c., mill. Black sheets also remain unsteady.

The chief change in the production situation lies in the further reduction of merchant iron output. The No. 4 Iroquois furnace has been blown out for rebuilding. Its daily capacity will be increased from 400 to 500 tons. The two leading steel producers continue to report excellent operations. The Illinois Steel Co., notwithstanding recent losses in active blast furnace capacity, is producing steel at the rate of 93 per cent of ingot capacity. The Inland Steel Co. operations average 80 per cent and have been helped in the sheet department by cooler weather. Of its 18 hot mills, 16 are now active.

Pig Iron.—A decline of $1 a ton in Northern prices and a further reduction of merchant iron production were the two leading developments of the week. The No. 4 Iroquois stack has been blown out for rebuilding. This leaves seven active merchant furnaces out of a total of 13 in this territory. The stacks still producing include two Iroquois, two Federal, one Mayville, and the Thomas and Zenith furnaces. In addition, a local steel works continues to offer part of its blast furnace output for general sale. Prices have receded from $27, base, furnace, to $26, this price being f.o.b. producing point, whether it be in Chicago or Wisconsin. Competition for business is keen and there are already reports of shading under the new price, as low as $25.76, delivered, Milwaukee, having been reported. The maximum going price on Southern iron appears to be $21, base, Birmingham, and while some furnaces are holding for more, they are not getting any business. In northern Indiana and western Michigan, the competition of Lake Erie furnaces continues to be felt. As high as 3 per cent silicon foundry has been sold by these producers at base prices, silicon differentials having been waived. Current sales are largely of small tonnages for early shipment, melters being indisposed to contract for any time ahead. Inquiries are probably somewhat more numerous than heretofore, indicating that price reductions have developed more widespread interest in the market. In view of the fact that prices have receded $6 a ton since the decline began, some buyers are frank to state that if the bottom has not been reached, it must be close at hand. A local melter has closed for 350 tons of foundry at $26, base, furnace for 30 days' delivery. A southern Michigan user is inquiring for 500 tons of Southern foundry for fourth quarter. A Wisconsin melter wants 300 tons of foundry for 30 days' shipment. A Milwaukee plant has closed for 500 tons of low phosphorus. A Chicago buyer is in the market for 200 tons of 15 per cent Bessemer ferrosilicon.

Quotations on Northern foundry high phosphorus malleable and basic irons are f.o.b. local furnace and do not include an average switching charge of 61c. per ton. Other prices are for iron delivered at consumer's yard or when so indicated, f.o.b. furnace other than local.

Lake Superior charcoal, averaging sil. 1.50, delivered at Chicago	$32.04 to $32.15
Northern coke, No. 1, sil. 2.25 to 2.75	26.50
Northern coke, foundry No. 2, sil. 1.75 to 2.25	26.00
Malleable, not over 2.25 sil.	26.00
Basic	26.00
High phosphorus	26.00
Southern No. 2	27.01
Low phos., sil. 1 to 2 per cent, copper free	34.00
Silvery, sil. 8 per cent	39.29

Ferroalloys.—Ferromanganese is weak and recent sales have been made at $109, seaboard. Spiegeleisen has also declined and can now be bought at from $48 to $49, delivered.

We quote 80 per cent ferromanganese, $116.56 to $117.38, delivered; 50 per cent ferrosilicon, $85 to $87, delivered; spiegeleisen, 18 to 22 per cent, $48 to $49, delivered.

Plates.—Orders for oil storage tanks placed with local fabricators involve a total of 14,000 tons of plates. Considerable additional tank business is said to be in prospect although inquiries actually active at this time are few. Railroad car buying continues to be light, but the carriers are showing renewed interest in the repair of their old equipment as cars ordered earlier in the year are delivered to them by builders. Mills are pressed for deliveries of plates against old orders, but their new business does not equal the current rate of production.

The mill quotation is 2.60c., Chicago. Jobbers quote 3.30c. for plates out of stock.

Cast Iron Pipe.—Lake County, Ohio, which recently rejected bids on 1200 tons, will receive revised figures Sept. 28. Orrville, Ohio, took bids yesterday on 500 tons, and Algoma, Wis., received tenders on 125 tons on the same day. Late last week, Port Huron, Mich., took bids on 250 tons and Berne, Ind., took figures on 300 tons. Prices are slightly easier. Sizes above 12-in. are not bringing over $49, Birmingham, and sometimes less than that, while 6- to 12-in. can be bought at $51, Birmingham, and in mixed lots with larger pipe at a lower figure.

We quote per net ton, f.o.b. Chicago, as follows: Water pipe, 4-in., $63.20 to $64.20; 6-in. to 12-in., $59.20 to $60.20; above 12-in., $57.20; class A and gas pipe, $5 extra.

Sheets.—Indirectly Chicago mills have felt the effect of the Japanese earthquake to the extent of taking several orders for material to replenish stocks of Pacific Coast jobbers. These sales have consisted largely of galvanized sheets and up to date have not involved any great amount of tonnage. Generally speaking, demand for sheets shows no change. Consumers are not buying ahead, preferring to place small orders for their immediate needs. Local mills are still comfortably booked, but outside producers are in a position to make quick shipments.

Mill quotations are 3.75c. to 3.85c. for No. 28 black, 3c. for No. 10 blue annealed and 5c. for No. 28 galvanized, all being Pittsburgh prices, subject to a freight rate to Chicago of 34c. per 100 lb.
Jobbers quote, f.o.b. Chicago, 4.35c. for blue annealed, 5.20c. for black and 6.35c. for galvanized.

Bolts and Nuts.—Specifications continue to improve somewhat as the end of the quarter approaches, but they are not coming in with the rush which was expected in some quarters when the new list prices were announced. Contracting for fourth quarter is proceeding slowly, indicating that buyers have not forsaken their policy of extreme caution. Discounts are shown on page 862, being on an f.o.b. Chicago basis in this district.

Jobbers quote structural rivets, 4c.; boiler rivets, 4.20c.; machine bolts up to ⅞ x 4 in., 45 and 5 per cent off; larger sizes, 45 and 5 off; carriage bolts up to ¾ x 6 in., 40 and 5 off; larger sizes, 40 and 5 off; hot pressed nuts, squares and hexagons, tapped, $2.50 off; blank nuts, $2.50 off; coach or lag screws, gimlet points, square heads, 50 and 5 per cent off.

Rails and Track Supplies.—No new rail orders are reported, but a fair amount of track supply business is being placed. The Great Northern placed 500 tons of bolts and spikes and 1000 tons of tie plates with a local mill, these orders being in addition to those mentioned a week ago.

Standard Bessemer and open-hearth rails, $43; light rails, rolled steel, 2.25c. f.o.b. makers' mills.

Standard railroad spikes, 3.25c. mill; track bolts with square nuts, 4.25c. mill; iron tie plates, 2.85c. mill; steel tie plates, 2.60c., f.o.b. mill; angle bars, 2.75c., f.o.b. mill.

Jobbers quote standard spikes out of warehouse at 3.90c. base and track bolts, 4.90c. base.

Structural Material.—Fabricated lettings for the week total 2160 tons, but heavier inquiry has developed, raising the hopes of the trade for an active fall. A power plant in Indiana will involve 4000 tons while six other active prospects account for 2900 tons more. Buyers of plain material continue to follow a cautious policy and while orders are being placed, they involve small tonnages. Mills continue to ship freely against old commitments, but are not booking new tonnage as fast as they are delivering old.

The mill quotation on plain material is 2.60c., Chicago. Jobbers quote 3.30c. for plain material out of warehouse.

Wire Products.—Although the business now coming in is characterized as fair, it falls short of shipments. Most mills are now sufficiently caught up on deliveries to offer prompt shipments on practically all forms of wire products. Prices are unchanged and steady. For mill prices, see finished iron and steel, f.o.b. Pittsburgh, page 862.

We quote warehouse prices f.o.b. Chicago: No. 6 to No. 9 bright basic wire, $3.90 per 100 lb.; extra for black annealed wire, 15c. per 100 lb.; common wire nails, $3.80 per 100 lb.; cement coated nails, $3.25 per keg.

Reinforcing Bars.—Competition for available business has grown keener and prices are soft. Although there is considerable variation in quotations on different current projects, the market appears to have settled at about 2.75c., Chicago warehouse. Lettings include:

Fish Furniture Co. warehouse, Chicago, 400 tons to Olney J. Dean.

Commodore Hotel building, Chicago, 400 tons to American System of Reinforcing.

Perry Creek conduit, Sioux City, Iowa, 700 tons to Fort Dodge Rolling Mill Co.

U. S. Reclamation Service, Denver, 300 tons to Colorado Fuel & Iron Co.

Commonwealth Edison Co., Crawford Avenue station, Chicago, 450 tons to Concrete Steel Co.

Madison Square Bank building, Chicago, 100 tons to Joseph T. Ryerson & Son.

Addition to Banner Laundry, Detroit, 100 tons to McRae Steel Co.

Buena Vista Apartment building, Chicago, 400 tons to American System of Reinforcing instead of to another fabricator as reported last week.

Pending business includes:

Knights of Columbus clubhouse, Madison Street and Cicero Avenue, Chicago, 325 tons.

Goss Printing Press Co. plant addition, Chicago, 100 tons.

Bars.—Current orders for soft steel bars are largely for small tonnages. Buyers apparently do not see any possibility for an early advance in prices and finding available deliveries satisfactory, see no advantage in buying ahead. While current business is not equal to shipments, mills find encouragement in the pressure for delivery of old tonnage. Consumption is well sustained in most directions and shows slight improvement where it has been subnormal. Forge shops are unusually busy, and automobile manufacturers, while not so active as earlier in the year, are nevertheless exceeding all production records for this season. The most promising development, however, has been the receipt of heavier specifications from the farm implement industry. The tonnage involved is not yet particularly large when compared with the normal consumption by agricultural machinery makers and is chiefly significant because it marks the first change for the better in months. Present operations of the implement manufacturers probably do not average more than 40 or 50 per cent. Bar iron has shown further weakness because of slack demand and now ranges from 2.35c. to 2.40c., Chicago, with a considerable proportion of current orders going at the lower figure. One important bar iron mill is idle because of lack of business. Hard steel bars are still firm at 2.30c., mill. Mills apparently prefer to curtail or suspend operations entirely rather than reduce their prices to an unprofitable level.

Mill prices are: Mild steel bars, 2.50c., Chicago; common bar iron, 2.35c. to 2.40c., Chicago; rail steel, 2.30c., Chicago mill.

Jobbers quote 3.20c. for steel bars out of warehouse. The warehouse quotation on cold-rolled steel bars and shafting is 4.55c. per rounds and 5.05c. for flats, squares and hexagons.

Jobbers quote hard and medium deformed steel bars at 2.75c. base; hoops, 4.55c.; bands, 3.95c.

Coke.—The market is exceedingly quiet. Local by-product foundry is unchanged at $13.50, delivered, Chicago switching district. Beehive foundry is quoted at $5.25 to $5.50, f.o.b. Connellsville.

Old Material.—Users have withdrawn from the market almost entirely and prices have declined generally from 50c. to $1 a ton. Mills refuse to pay more than $16, delivered, for heavy melting, although dealers are still taking it at $16.50 to apply on old orders. Consumer demand for cast and malleable grades, which was the only feature a week ago, has subsided. Railroad offerings include the Santa Fe, 6000 tons; Chicago surface lines, 1000 tons; and the Big Four, a blind list.

We quote delivery in consumers' yards, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton

Iron rails	$21.00 to $21.50
Cast iron car wheels	19.50 to 20.00
Relaying rails, 56 and 60 lb.	26.00 to 27.00
Relaying rails, 65 lb. and heavier	32.00 to 35.00
Rolled or forged steel car wheels	20.50 to 21.00
Rails for rolling	17.00 to 17.50
Steel rails, less than 3 ft.	20.00 to 21.50
Heavy melting steel	16.00 to 16.50
Frogs, switches and guards cut apart	16.25 to 16.75
Shoveling steel	15.75 to 16.25
Drop forge flashings	11.00 to 11.50
Hydraulic compressed sheets	12.50 to 13.00
Axle turnings	13.00 to 13.50
Steel angle bars	18.00 to 18.50

Per Net Ton

Iron angle and splice bars	21.50 to 22.00
Iron arch bars and transoms	21.50 to 22.00
Iron car axles	25.00 to 25.50
Steel car axles	18.50 to 19.00
No. 1 busheling	13.00 to 13.50
No. 2 busheling	9.50 to 10.00
Cut forge	14.50 to 15.00
Pipes and flues	9.50 to 10.00
No. 1 railroad wrought	15.00 to 15.50
No. 2 railroad wrought	14.50 to 15.00
Steel knuckles and couplers	19.00 to 19.50
Coil springs	19.50 to 20.00
No. 1 machinery cast	19.50 to 20.00
No. 1 railroad cast	19.00 to 19.50
No. 1 agricultural cast	19.50 to 20.00
Low phos. punchings	16.50 to 17.00
Locomotive tires, smooth	15.50 to 16.00
Machine shop turnings	8.90 to 9.00
Cast borings	10.50 to 11.00
Short shoveling turnings	10.50 to 11.00
Stove plate	16.50 to 17.00
Grate bars	14.50 to 15.50
Brake shoes	15.50 to 16.00
Railroad malleable	19.00 to 19.50
Agricultural malleable	17.50 to 18.00

Detroit Scrap Market

DETROIT, Sept. 25.—One of the largest producers is offering 3500 tons of turnings, borings, flashings and regular hydraulic compressed for October delivery. Melters in this district are buying for current needs only.

The following prices are quoted on a gross ton basis, f.o.b. cars producers' yards, excepting stove plate, automobile cast and No. 1 machinery cast, which are quoted on a net ton basis:

Heavy melting steel	$15.50 to $17.00
Shoveling steel	15.50 to 17.00
No. 1 machinery cast	19.00 to 20.00
Cast borings	11.50 to 13.00
Automobile cast scrap	25.00 to 27.00
Stove plate	16.00 to 17.00
Hydraulic compressed	13.00 to 14.00
Short turnings	12.50 to 13.00
Long turnings	10.00 to 11.00
Flashings	10.00 to 11.00

New York

Plates Now 2.40c—Limited Buying of Pig Iron at Low Prices

NEW YORK, Sept. 25.—The pig iron market is weak and competition active on the limited tonnage which has been pending. On a sale of 2000 tons of foundry iron to a Bridgeport melter for delivery within 60 days, it is understood that 1000 tons went to a Nova Scotia company at about $26, delivered, and that an Eastern steel company went to nearly as low a price but failed to get any of the business, while a second 1000 tons went to a northern New York company. The Richardson & Boynton Co., Dover, N. J., which had been in the market for 5000 tons, of which 1000 tons was for delivery this year and the remainder next year, has placed an order for 1000 tons and held the remainder in abeyance awaiting market developments. The New York Central & Hudson River Railroad, which inquired for 700 tons of various grades, is reported to have placed its tonnage with different furnaces. The New York Air Brake Co. has not yet closed on 1000 tons for which it has been in the market. The Gould Coupler Co., Depew, N. Y., is again in the market for 2000 tons of malleable and the General Electric Co. is inquiring for 800 tons of iron, 3.25 to 3.75 per cent silicon, for delivery at Pittsfield, Mass. The trend of prices is downward. While eastern Pennsylvania is still quoted at $25 for No. 2 plain, it is weak at that price and reports indicate that $24.50 could easily be done. Probably iron could be had at $24, Buffalo.

We quote delivered in the New York district as follows, having added to furnace prices $2.27 freight from eastern Pennsylvania, $4.91 from Buffalo and $5.44 from Virginia:

East. Pa. No. 1X fdy., sil. 2.75 to 3.25	$27.77 to $28.27
East. Pa. No. 2X fdy., sil. 2.25 to 2.75	26.77 to 27.27
East. Pa. No. 2, sil. 1.75 to 2.25	26.77 to 27.27
Buffalo, sil. 1.75 to 2.25	29.41
No. 2X Virginia, sil. 2.25 to 2.75	31.94
No. 2 Virginia, sil. 1.75 to 2.25	31.44

Ferroalloys.—In view of the fact that ferromanganese is being sold anywhere from about $109 to $112, seaboard basis, it would not be surprising if British producers should lower their asking price from $117.50, seaboard, at which level they are not taking any business. With a clearing up of the Ruhr situation, there is the possibility of more demand for the British alloy on the Continent and this might affect any decision to lower prices. Such demand as there is is confined to carload lots. Demand for spiegeleisen is also made up of small lots, prices for which are unchanged. There is no particular activity in the 50 per cent ferrosilicon market and quotations are the same as they have been for some months.

Cast-Iron Pipe.—Makers continue sold up until well toward the end of the year. No award has yet been made of the 4000 tons of 6-in. to 20-in. water pipe by the Department of Water Supply, Gas and Electricity, New York, bids on which were opened Sept. 7. No early disposal of the 20,500 tons of water pipe for the city of Manila, P. I., pending for some time and under litigation in the Philippine courts, is expected by the bidders. We quote per net ton, f.o.b. New York, in carload lots, as follows: 6-in. and larger, $63.60; 4-in. and 5-in., $68.60; 3-in., $78.60, with $5 additional for Class A and gas pipe. Business in soil pipe is still fairly heavy, with fully 90 per cent of the present purchasing for as prompt delivery as possible. Makers are booked for about two months in advance and discounts are unchanged. We quote discounts of both Southern and Northern makers, f.o.b. New York, in carload lots, as follows: 6-in. standard, 34½ to 35¾ per cent off list; heavy, 44½ to 45¾ per cent off list.

Warehouse Business.—Although the market continues quiet, warehouses as a rule estimate that business for September will probably compare favorably with August, as a result of the slight improvement during the second half of the month. Prices are slightly firmer than was the case several weeks ago, very little inclination to shade being evident, even on black and galvanized sheets, which are usually weaker than the rest of the market. The base price on black sheets seems fairly strong at a minimum of 4.75c. per lb. up to 5c. per lb., with galvanized sheets on a basis of 5.75c. and 6c. per lb. Since the settlement of the strike that has been in effect in Sweden for many months, the price of Swedish charcoal iron bars out of stock in New York has declined 25c. per 100 lb. to 7.25c. per lb. When the heavy demand following the strike settlement has somewhat subsided, importers look for another slight reduction. Prices of brass and copper products out of stock have been reduced ½c. to 1c. per lb. in most instances. We quote prices on page 880.

We quote for mill shipments, New York delivery, as follows: Soft steel bars, 2.74c.; plates and structural shapes, 2.84c.; bar iron, 2.74c.

Coke.—The market continues weaker and buyers have apparently adopted an attitude of waiting for low prices. A recent inquiry from a northern New York company for 1500 tons of foundry coke is reported to have been temporarily postponed. Standard furnace coke is quotable at from $4.50 to $5 per ton and standard foundry coke ranges from $5.50 per ton up, with lots available, it is claimed, as low as $5.25 per ton. By-product coke is quoted at $11.41, Newark and Jersey City.

Old Material.—Although activity is diminishing somewhat, prices on most grades of scrap are reported to be holding fairly firm. So few transactions are reported that quotations are largely nominal. Heavy melting steel continues unchanged at $16.50 and $17 per ton, delivered to consumer in eastern Pennsylvania, but it is reported that the $17.50 price paid for delivery to Pottsville, Pa., has disappeared. Railroad quality is holding at $16.50 per ton, delivered eastern Pennsylvania. Borings and turnings are quiet, shipments to plants of the leading independent having been suspended. Stove plate is unchanged in price and shipments are still going forward to New Jersey foundries at about $18 per ton, delivered. Some tonnage has also gone to a Bridgeport, Conn., consumer at $18.50, delivered. Shipment of stove plate to Harrisburg by dealers has resulted, it is said, in a surplus of a number of carloads still in the hands of the sellers. Machine shop turnings are no longer reported going forward to Phoenixville, but borings and turnings are being shipped to consumers at Johnstown, Riddlesburg and Swedeland. Both rails for rolling and relaying rails are inactive in this district and prices quoted are largely nominal.

Buying prices per gross ton New York follow:

Heavy melting steel, yard	$13.00 to $13.50
Steel rails, short lengths, or equivalent	13.50 to 14.00
Rails for rolling	15.00 to 17.00
Relaying rails, nominal	25.00 to 26.00
Steel car axles	19.00 to 20.00
Iron car axles	25.00 to 26.00
No. 1 railroad wrought	14.50 to 15.00
Wrought iron track	13.50 to 14.00
Forge fire	10.00 to 10.50
No. 1 yard wrought, long	13.00 to 13.50
Cast borings (clean)	11.00 to 12.00
Machine-shop turnings	10.25 to 10.75
Mixed borings and turnings	9.50 to 10.00
Iron and steel pipe (1 in. diam., not under 2 ft. long)	12.00 to 12.50
Stove plate	15.50 to 16.00
Locomotive grate bars	13.50 to 14.50
Malleable cast (railroad)	18.00 to 19.00
Cast-iron car wheels	17.50 to 18.50

Prices which dealers in New York and Brooklyn are quoting to local foundries per gross ton follow:

No. 1 machinery cast	$20.00 to $21.00
No. 1 heavy cast (columns, building materials, etc.), coupola size	19.00 to 20.00
No. 1 heavy cast, not cupola size	17.00 to 18.00
No. 2 cast (radiators, cast boilers, etc.)	17.00 to 18.00

Finished Iron and Steel.—Keen competition among Eastern plate mills for the little tonnage that is to be had has resulted in a break in the 2.50c. price, which had held firmly for months. Some mills have quoted 2.40c., Pittsburgh, and on 300 tons bought by the Standard Oil Co. of New Jersey it is believed in the trade that less than 2.40c., Pittsburgh, was quoted by at least one mill. Most of the Eastern plate mills are now down to about a 50 per cent operation, and their backlogs are light. Structural steel mills adhere to 2.50c., Pittsburgh, on plain material despite quotations of $2 and $3 a ton under this price by one small Eastern mill. There is fair activity in structural steel, but the pace of lettings of week before last was not maintained last week. However, inquiries are fairly nu-

merous for this time of year, though some that were considered active have been withdrawn. In general steel business there has been no improvement in the volume of inquiry and orders. Jobbers are buying sparingly for fourth quarter shipment, while manufacturing consumers are buying even more sparingly. Tin plate and pipe are the most active of all steel products. Prompt deliveries of plates, shapes and bars are available from nearly all mills. There is no revival of inquiry for railroad equipment, but a few roads are in the market for passenger and baggage cars.

Cincinnati

Southern Iron Recedes to $21, But Some Furnaces Are Quoting Higher

CINCINNATI, Sept. 25.—The pig iron market is dull and prices weak, particularly on Southern irons which have declined $2 during the past 10 days. Southern iron can now be bought at $21, Birmingham, base, from at least one furnace, and while one or two others are reported to be asking $23 to $24, it is generally felt that an attractive order could be easily placed at $21 if not slightly lower. The drop to lower levels was probably the result of a reported purchase by a large pipe company of 25,000 tons at $21.50. While the details of this sale cannot be learned, it is known that at least one of the larger pipe companies paid $22 base for a small tonnage. The largest sale of Northern iron reported was to a central Ohio melter, 2400 tons of foundry and malleable grades at around $24.50, Ironton. This price probably could be duplicated on a round tonnage; but carload sales are generally made at $25, base. There is little inquiry, the L. & N. Railroad being in the market for 500 tons and a Michigan melter for a similar amount, both of Southern iron.

Based on freight rates of $4.05 from Birmingham and $2.27 from Ironton, we quote f.o.b. Cincinnati:

Southern coke, sil. 1.75 to 2.25 (base)	$25.05
Southern coke, sil. 2.25 to 2.75 (No. 2 soft)	25.55
Ohio silvery, 8 per cent	36.77
Southern Ohio coke, sil. 1.75 to 2.25 (No. 2)	26.77
Basic Northern	26.77
Malleable	26.77

Sheets.—There is more inquiry for fourth quarter tonnages, but on the whole consumers are simply covering for their needs as they develop. Less is heard of shading of prices, and it is difficult to find a buyer who has placed any orders at less than the regular schedule. Automobile body sheets continue in good demand at the established price of 5.35c.

Reinforcing Bars.—A hotel at Memphis, Tenn., requiring about 800 tons of bars, will be up for bids in the next week or two. Highway construction in Ohio will require about 600 tons, the contracts having been let this week. A number of other projects are ready for bids, including the foundation work for the new Neil House at Columbus, and the foundation for the Masonic Temple at Springfield, Ohio. Prices generally quoted range from 2.25c. for rerolled bars, to 2.40c for new billet stock.

Structural Material.—No new inquiries appeared during the week, and the lettings generally were for less than 100 tons. A hotel at Portsmouth, Ohio, on which bids were taken, and involving 300 tons, will not go ahead now. A school building at Columbus, Ohio, will be up shortly, and will require from 300 to 350 tons.

Finished Materials.—Orders are made up mostly of specialties. Railroad spikes, bolts and nuts, boiler tubes, car wheels and forgings have been moving in good shape, but there is little activity in bars and plates. Structural shapes have been fairly active during the past few weeks, but a lull was noticed in the demand the past few days. Plates are not being bought in any sizable tonnages, and reports indicate that boiler and tank manufacturers have materially slowed up in operations. Prices, however, continue firm, and on several carload orders of light rails placed during the past week, 2.25c. was done. While there is some talk of lower plate prices in the East, apparently Pittsburgh district mills are holding firmly to the 2.50c. price, as a consumer in this territory was unable to develope a lower price on an inquiry for over 1000 tons.

Warehouse Business.—Local jobbers reported a heavy demand for hoops and bands during the past week. Other materials are moving in fair volume, but the tonnages generally are light, as mills are in good position to make delivery on practically all products. There has been no change in prices.

Cincinnati jobbers quote: Iron and steel bars, 3.50c.; reinforcing bars, 3.60c.; hoops, 4.55c.; bands, 4.25c.; shapes, 3.60c.; plates, 3.60c.; cold-rolled rounds, 4.50c.; cold-rolled flats, squares and hexagons, 5c.; No. 10 blue annealed sheets, 4.25c.; No. 28 black sheets, 5.35c.; No. 28 galvanized sheets, 6.35c.; No. 9 annealed wire, $3.60 per 100 lb.; common wire nails, $3.60 per keg base.

Coke.—The coke market is showing a little more activity; but prices continue to sag. Connellsville foundry coke is now quoted at $5 to $6 and Wise County foundry $6 to $7. A by-product producer in the district is expected to reduce the price on October contracts $1 per ton. New River foundry is unchanged at $12 for prompt shipment.

Old Material.—Outside of a purchase of cast by a large interest with a plant in the district, the scrap market is quiet. A small sale of couplers and knuckles was also reported. Offerings are heavier, particularly from the railroads and prices are inclined to lower levels. In fact, the whole list is affected and dealers have been able to buy for yard stocks at 50c. to $1 per ton under last week's prices.

We quote dealers' buying prices, f.o.b. cars Cincinnati:

Per Gross Ton

Bundled sheets	$12.50 to $13.00
Iron rails	15.50 to 16.00
Relaying rails, 50 lb. and up	28.50 to 29.00
Rails for rolling	16.50 to 17.00
Heavy melting steel	15.00 to 15.50
Steel rails for melting	15.00 to 15.50
Car wheels	15.00 to 15.50

Per Net Ton

No. 1 railroad wrought	13.00 to 13.50
Cast borings	9.00 to 9.50
Steel turnings	9.00 to 9.50
Railroad cast	16.50 to 17.00
No. 1 machinery cast	18.50 to 19.00
Burnt scrap	12.00 to 12.50
Iron axles	23.00 to 23.50
Locomotive tires (smooth inside)	13.50 to 14.00
Pipes and flues	9.00 to 10.50

Canadian Scrap Market

TORONTO, ONT., Sept. 24.—Trading in iron and steel scrap in the Canadian market is beginning to show renewed life. While the demand for scrap is slowly picking up, business is still far from normal, and what orders dealers are receiving are almost entirely confined to small tonnage for the immediate use of consumers. Neither steel plants nor foundries are interested in scrap for last quarter and up to the present no contracts for this period have been made. While Toronto dealers have made no further change in their buying prices, a few slight changes have been announced by Montreal dealers.

Prices Canadian dealers are offering for iron and steel scrap are as follows:

Dealers' Buying Prices—Gross Tons

	Toronto	Montreal
Steel turnings	$10.00	$7.00
Machine shop turnings	10.00	7.00
Wrought pipe	8.00	8.00
Rails	14.00	13.50
No. 1 wrought scrap	14.00	14.00
Heavy melting steel	14.00	11.50
Steel axles	16.00	18.00
Axles, wrought iron	18.00	20.00
Net Tons		
Standard car wheels	15.00	16.00
Malleable scrap	15.00	16.00
Stove plate	15.00	16.00
No. 1 machinery cast	19.00	20.00

St. Louis

Buying of Pig Iron Not So Active—Stove Plants Are Busy

ST. LOUIS, Sept. 25.—Buying of pig iron was much less this week than the previous seven days. The St. Louis Coke & Iron Co. sold a few carload lots and up to 200 tons, this maker being well booked with orders. There is an inquiry before the market for 5000 tons of basic iron from an East Side melter and an Illinois melter wants 200 tons for first quarter delivery. Melters who are not well supplied with pig iron are buying only from hand to mouth. However, business is improving, the stove factories in the district operating at high capacity, and the job foundries report taking on more orders. The market for Northern iron is easier, with quotations being made at $26, Chicago. Southern iron is selling as low as $22, Birmingham, the low price being made by a Tennessee maker. However, with a freight rate to St. Louis of $4.45, as compared with $5.17, the all-rail rate from Birmingham, the Tennessee makers have an advantage of 72c. Two lots of 100 tons each of Bessemer ferrosilicon were sold.

We quote delivered consumers' yards, St. Louis, as follows, having added to furnace prices $2.15 freight from Chicago, $3.28 from Birmingham (rail and water), $5.17 from Birmingham, all rail, and 81 cents average switching charge from Granite City:

Northern fdy., sil. 1.75 to 2.25	$28.16
Northern malleable, sil. 1.75 to 2.25	28.16
Basic	28.17
Southern fdy., sil. 1.75 to 2.25	27.17

Coke.—The market for foundry coke is rather quiet. Sales of Connellsville grades were made during the week at $5.75 to $7.25 for spot shipment and $6.50 to $7.75 for future shipment. Cooler weather has stimulated a consumer demand for coke, and dealers are buying more liberally.

Old Material.—Consumers of old material in the district are still buying only such specialties as they may actually need, and this is a small factor, or "distress" cars, which they pick up at almost their own price. Only a few of such cars are to be had. Dealers continue to absorb all railroad offerings, which were smaller than for several months. The only new lists were: Kansas City, Mexico & Orient, 300 tons, and Kansas City Terminal Railway, 600 tons. The quotation on steel car axles in our issue of Sept. 6 should have been $18.50 to $19 per net ton.

We quote dealers' prices f.o.b. consumers' works, St. Louis industrial district and dealers' yards, as follows:

Per Gross Ton	
Iron rails	$16.00 to $16.50
Rails for rolling	17.50 to 18.00
Steel rails less than 3 ft	19.50 to 20.00
Relaying rails, 60 lb. and under	26.00 to 27.00
Relaying rails, 70 lb. and over	33.50 to 34.50
Cast iron car wheels	18.50 to 19.00
Heavy melting steel	16.50 to 17.00
Heavy shoveling steel	16.50 to 17.00
Frogs, switches and guards cut apart	16.50 to 17.00
Per Net Ton	
Heavy axles and tire turnings	12.50 to 13.00
Steel angle bars	16.00 to 16.50
Iron car axles	25.00 to 26.00
Steel car axles	18.50 to 19.00
Wrought iron bars and transoms	20.00 to 21.00
No. 1 railroad wrought	15.00 to 15.50
No. 2 railroad wrought	15.00 to 15.50
Railroad springs	18.00 to 18.50
Cast iron borings	11.50 to 12.00
No. 1 busheling	15.75 to 16.25
No. 1 railroad cast	19.50 to 20.00
No. 1 machinery cast	20.00 to 20.50
Railroad malleable	17.00 to 17.50
Machine shop turnings	11.50 to 12.00
Champion bundled sheets	8.00 to 8.50

Finished Iron and Steel.—The market for finished iron and steel products is very quiet. The only railroad inquiry has been issued by the Missouri-Kansas-Texas and is for 150 tons of miscellaneous steel castings for locomotives and cars and 87 tons of locomotive and car bolsters and side frames, being fourth quarter requirements. The contract for 1700 tons of reinforcing bars for the first of three units of the municipal docks at Houston, Tex., went to the Knoxville Iron Co. A few railroads have requested prices on machine bolts and nuts for fourth quarter delivery. Jobbers are showing only an interest in a few special items.

For stock out of warehouse we quote: Soft steel bars, 3.35c. per lb.; iron bars, 3.35c.; structural shapes, 3.45c.; tank plates, 3.45c.; No. 10 blue annealed sheets, 4.45c.; No. 28 black sheets, cold rolled, one pass, 5.20c.; cold drawn rounds, shafting and screw stock, 4.45c.; structural rivets, 4.15c.; boiler rivets, 4.25c.; tank rivets, ⅞-in. and smaller, 50-5 per cent off list; machine bolts, 45-5 per cent; carriage bolts, 40-5 per cent; lag screws, 50-5 per cent; hot pressed nuts, square or hexagon blank, $2.50; and tapped, $2.50 off list.

Birmingham

Sale to Leading Pipe Interest with Concession of $2 for "Off Grade" Iron

BIRMINGHAM, Sept. 25—Practically the only item of interest which has occurred during the week in pig iron circles to cause undue comment is the reported sale of 25,000 tons of Birmingham iron to the large pipe interest at $23 base price, with a concession of $2 per ton for "off grade" iron which may be produced during the interim of manufacture of this tonnage on one furnace. Sale prices of $21 per ton for silicon 1.75 to 2.25 per cent have been reported in Northern markets, though Birmingham producers stoutly maintain that quotations are on the basis of $24. Sales have been made to Southern and Southwestern consumers on the $24 price, with liberal allowances in silicon content. However, the fact remains that there has been no great volume of business booked, with the exception of the 25,000 ton order, since the slump in price from $27 to $23 per ton, and a fair percentage of current make at the present time is finding its way on the yards. Within the past three weeks, a total of three furnaces on foundry iron has been blown out; and unless there is created a much greater incentive on the part of buyers to take on new business and "speed up" current movements of iron on old orders, from two to three additional furnaces will likely be found on the idle list by the end of October. Outside of the large pipe interest, there have been no forward bookings of consequence made by Southern pipe manufacturers; and this class of business is really the "backbone" of Southern iron consumption. Charcoal iron production is practically nil at the present time, there being produced only about 60 tons per day, and the market is quite inactive.

We quote per gross ton f.o.b. Birmingham district furnaces as follows:

Foundry, silicon 1.75 to 2.25	$22.00 to $23.00
Basic	24.00
Charcoal, warm blast	$33.00 to 34.00

Cast-Iron Pipe.—The high pressure pipe plants of the district are reported to be in very comfortable shape—each week finding some new business placed. Manufacturers state that the orders on hand are quite sufficient to insure uninterrupted operations for the remainder of this year. The soil pipe interests continue to operate at about 50 per cent.

Coal and Coke.—Notwithstanding the near approach of winter months, the coal trade has not responded to the demands anticipated by dealers, and some of the mines are experiencing difficulty operating three days per week. Foundry coke is firmly quoted at $8 per ton at the ovens and domestic coke $6.50. Operations of the one commercial by-product plant continue 100 per cent, but certain beehive ovens which have had a reputation for years on foundry coke are experiencing a relatively slack business. With the advent of by-product coke in the district, there has been created a substantial domestic coke market which has not existed heretofore.

E. L. Ford of Youngstown, leading stockholder in the American Puddled Iron Co., which is completing a plant in Warren, Ohio, for the mechanical production of puddled iron, stated this week that actual production would not begin before Nov. 1. It was the original intention to start operations about Oct. 1, but delays have caused the postponement.

Buffalo

Improvement in Inquiry and Sales of Pig Iron But Not in Prices

BUFFALO, Sept. 25.—Decided improvement in inquiry and sales is found by all but one producer. About 15,000 tons of various grades of foundry and malleable has been taken on as new business and while the smaller lots were sold at $25 base, the larger tonnages brought price concessions. A farm implement maker near Buffalo bought 2000 tons of foundry and malleable and it is reported that a flat price of $23.50 was made. This lacks confirmation. A number of other large inquiries engaged Buffalo sellers, but the fact that the majority are from Eastern points discouraged local producers in quoting. As a general proposition, local sellers are satisfied that present price schedules are the highest that can be made at this time. The furnaces have not sufficient backlogs to enable them to maintain higher schedules. The Bethlehem Steel Corporation is again quoting on pig iron and is booking tonnages for fourth quarter delivery of Lackawanna iron. Buffalo sellers quoted on the 2000-ton inquiry put out by the northern New York railroad equipment maker, but the delivery point is outside the area where Buffalo furnaces can compete. Furnace operation is maintained without change.

We quote f.o.b gross ton Buffalo as follows:

No 1 foundry, 2.75 to 3.25 sil.	$25.00 to $25.50
No. 2 foundry, 2.25 to 2.75 sil.	24.50 to 25.00
No. 2 plain, 1.75 to 2.25 sil.	24.50 to 25.00
Basic	26.00
Malleable	25.00
Lake Superior charcoal	32.28

Finished Iron and Steel.—New business in semi-finished material is being placed in satisfactory volume, but practically all buying is for immediate use and there is very little tendency to place any tonnages ahead. Prices are not disturbed; the only recent departure from the schedules that have been in effect for several months, was the quotation on structural shapes reported last week in THE IRON AGE. It is since learned that this concession came from a mill ordinarily not active in this district. Slight concessions in the price of cold-rolled material are reported; the prevailing figure has been 3.25c., but isolated quotations of 3.15c. have been heard of. Plate demand is quiet, but on tubular products and wire demand is strong and pressure for delivery insistent. The 2500-ton inquiry for pipe for shipment to South America is still open. A large portion of bar and shape buying is for fill-in purposes. The Bethlehem Steel Corporation will supply the shapes for the Niagara Hotel, Niagara Falls, N. Y., 800 tons, and 1800 tons for the new Knights of Columbus home at Rochester.

We quote warehouse prices Buffalo as follows: Structural shapes 3.65c.; plates 3.65c.; soft steel bars 3.55c.; hoops, 4.65c.; bands, 4.35c.; blue annealed sheets, No 10 gage, 4.45c.; galvanized steel sheets, No. 28 gage, 6.35c.; black sheets, No. 28 gage, 5.25c.; cold rolled round shafting, 4.70c.

Old Material.—One mill has bought a considerable tonnage of heavy melting steel and the consideration is understood to be $18. The other buyers are not anxious to place orders at this time notwithstanding they have little on hand. With the good-sized purchase by a mill interest plus lesser tonnages, about 10,000 tons has been sold.

We quote f.o.b. gross ton Buffalo as follows:

Heavy melting steel	$18.00 to $19.00
Low phos., 0.04 and under	23.50 to 24.50
No. 1 railroad wrought	15.00 to 16.00
Car wheels	16.50 to 17.00
Machine shop turnings	8.50 to 9.50
Cast iron borings	15.00 to 16.00
No. 1 bushelings	15.50 to 16.00
Stove plate	17.00 to 17.50
Grate bars	17.00 to 17.50
Bundled sheet stampings	10.00 to 11.00
No. 1 machinery cast	19.50 to 20.50
Hydraulic compressed	16.50 to 17.00
Railroad malleable	20.00 to 21.00

San Francisco

Principal Demand for Pig Iron Comes from Southern California Points

SAN FRANCISCO, Sept. 19.—There is little activity in iron and steel and both mills and foundries are taking very small lots. The fact is the dearth of buying orders is due directly to a lack of new business and at the moment there is little in the way of encouragement for the remaining months of the year and possibly longer. Prices on materials are easier than two weeks ago, and while there is a disposition to shade asking figures, such action would not stimulate trade under present conditions. The small establishments are fairly well supplied because of accumulations of the earlier months of the year, which by reason of slack business have lasted longer than expected, but some of the large concerns are making inquiries which may develop into business in the near future. Judging by the inquiries, however, the buying will be of very moderate proportions. The building industry, which has maintained a satisfactory volume through the summer, is slacking off and it is doubtful if any substantial recovery can be expected before spring. Other elements in the industrial situation are not materially changed, although it seems to be conceded that the trend toward increased dullness is unchecked.

Pig Iron.—There have been no transactions worthy of note for some time past and the demand is confined to small lots. Consumers are making more inquiries than two weeks ago, and this is taken as an indication that their supplies are at a low ebb, notwithstanding their assertions that they have all they need for some weeks. Prices are a trifle lower, the current quotations being from $34 to $35 per ton duty paid ex-ship. It is also noted that there is some disposition to shade asking figures to certain buyers, but this has had scarcely any effect as an inducement. The chief demand in this market at present is from Los Angeles and other southern California points. Considerable quantities of both domestic and imported iron have gone forward and new orders are still coming to hand from that quarter. Importers say there is practically no tonnage en route to this port by sea, but it is known that several moderate shipments of Scotch iron will start for this coast in the near future, to arrive probably in the latter part of December or early in January.

Coke.—Several sales of coke for both the San Francisco and Los Angeles districts have been made lately after a long period of inactivity. The price at present is about $20 per ton, ex-ship, with a small range of probably 50c. either way. Business has been light for so long that consumers are beginning to make inquiries, although orders are for the time being unimportant. An improved demand in sanitary lines is reported and these interests are in the field to fill their foundry coke requirements.

Old Material.—The trade is not backward in pronouncing business dull with every prospect that prices will be lower. Every effort is being made to maintain an optimistic outlook, but the fact is that prices are slightly lower than two weeks ago. Strictly first-class material is held at $15, but this is a maximum rate and in some quarters there is shading of this figure, occasionally as much as $1 per ton. During the last few days a cargo of 2600 tons of old material arrived from Chile, so this augmentation of supplies will serve to meet requirements for several weeks and possibly longer unless business should develop unexpected activity. Like pig iron, there has been considerable inquiry for desirable grades of old material from southern California, following increased orders for iron and steel parts in oil field equipment.

The Phillips Customs Body Co., Cleveland, has acquired by purchase the real estate and factory buildings in Warren, Ohio, of the Trumbull Mazda Lamp Co. Equipment will be installed for the manufacture of automobile bodies.

Philadelphia

Further Weakness in Pig Iron and Scrap—Steel Sales Gain Slightly

PHILADELPHIA, Sept. 25.—Some of the larger steel companies report that their total tonnage for September shows an increase over July and August, but the fact remains that new business is still far below the volume of shipments and the mills are eating into back orders at a rapid rate. Present indications are that there will be a declining rate of operation through the fourth quarter. This statement should be qualified by saying that this situation will affect plates, shapes and bars more than other products. The mills rolling pipe, wire products, sheets and tin plate are still in a fairly comfortable position as compared with that which exists in the three major products. Eastern plate mills are particularly hard hit by the lack of tonnage, and on the part of one or two mills there has been a disposition to break through the 2.50c. price on attractive lots. There is no question that 2.40c., Pittsburgh, has been done in a number of instances.

Raw materials also continue to show weakness. Foundry pig iron is quoted at $24.50, furnace, for No. 2 plain and at $25 for No. 2X and 50c. a ton under these prices has been quoted on a few desirable tonnages. Scrap is weak and some grades are lower in price. Coke and ferromanganese also show weakness.

Pig Iron.—The excess of production over consumption and the present very light demand for iron are factors which are seriously disturbing to the Eastern pig iron trade. The recent let-down in operations at Eastern steel mills increases the quantity of iron that is available for foundry use, and foundries are not buying, except in very small lots. This weak situation has brought a reduction of at least 50c. a ton in foundry iron prices, and it is conceded that on attractive business prices might go 50c. a ton lower, or to $24, base, furnace, and this latter price is said to have been quoted on a few lots. On the small lots, which make up the bulk of current business, most of the furnaces are getting $25 for No. 2 plain and $25.50 for No. 2X, but it is possible to get quotations of $24.50 and $25 on these grades. In other grades of iron there is no change. Last week 531 tons of pig iron from British India arrived here. The Bethlehem Steel Co. has banked three or four furnaces and has put one out at Johnstown and one at Sparrows Point for relining.

The following quotations are, with the exception of those on low phosphorus iron, for delivery at Philadelphia and include freight rates varying from 76 cents to $1.63 per gross ton:

East. Pa. No. 2 plain, 1.75 to 2.25 sil.	$25.26 to $26.13
East. Pa. No. 2X, 2.25 to 2.75 sil.	25.76 to 26.63
East. Pa. No. 1X	26.26 to 27.13
Virginia No. 2 plain, 1.75 to 2.25 sil.	30.17 to 30.67
Virginia No. 2X, 2.25 to 2.75 sil.	30.67 to 31.17
Basic delivered eastern Pa.	25.00
Gray forge	25.50 to 26.00
Malleable	26.26 to 26.84
Standard low phos. (f.o.b. furnace)	28.00 to 30.00
Copper bearing low phos. (f.o.b. furnace)	28.00

Ferroalloys.—Resale lots of ferromanganese are selling at from $108 to $110, seaboard or furnace, which is slightly lower than domestic furnaces are quoting. Spiegeleisen is being sold in carload lots at $44 to $45, furnace.

Plates.—Some of the Eastern plate mills are no longer adhering strictly to the 2.50c. plate price, which has been in effect for some months. In a few instances they have quoted 2.40c., Pittsburgh. On the small-lot business which makes up the bulk of the present light volume of buying they still quote 2.50c., but appear willing to go lower on any desirable orders. This break in price has been ignored by some of the larger mills, which, however, are watching the situation closely. Bids will be closed next week at Portland, Ore., on 13,000 tons of plates for pipe, and it is expected that Eastern mills will quote about 3c. per lb., delivered at Pacific Coast port, equivalent to 2.60c., Philadelphia, the present conference freight rate being 40c. per 100 lb. Two or three Pacific Coast tank builders have inquired for 5000 tons each, but the inquiries apparently are for the same job. There is no other plate business of importance in prospect. One of the Eastern plate mills has gone on a five-day week and if business does not increase soon will go to a single turn, while most of the others are operating this week at about 50 per cent.

Structural Steel.—Some buyers say they have received quotations of 2.35c., Pittsburgh, on structural shapes. However, one company which was believed to have made such quotations states that it has not gone below 2.40c., Pittsburgh. The latter price is apparently being freely quoted, though the larger mills still give 2.50c., Pittsburgh, as their only price. Bids have been taken at Detroit on a Philadelphia assembly plant for the Ford Motor Co., which will require about 5000 tons.

Bars.—Steel bar tonnage is light, being very much below the present volume of shipments, but there has been an improvement in demand this month over the two preceding months. Most of the orders are small, a carload to 100 tons, but they are more numerous.

Rails.—The Baltimore & Ohio Railroad has placed orders for 30,000 tons of rails with the Bethlehem Steel Co., Steel Corporation mills and the Inland Steel Co.

Warehouse Prices.—Following are the prices quoted by the local warehouses for steel out of stock:

Soft steel bars and small shapes, 3.55c.; iron bars (except bands), 3.55c.; round edge iron, 3.75c.; round edge steel, iron finished, 1½ x ½ in., 3.75c.; round edge steel planished, 4.55c.; tank steel plates, ¼ in. and heavier, 3.65c.; tank steel plates, ⅜ in., 3.95c.; blue annealed steel sheets, No. 10 gage, 4.25c.; black sheets, No. 28 gage, 5.15c.; galvanized sheets, No. 28 gage, 6.25c.; square twisted and deformed steel bars, 3.65c.; structural shapes, 3.65c.; diamond pattern plates, ¼-in., 5.40c.; ⅜-in., 5.60c.; spring steel, 5c.; round cold-rolled steel, 4.35c.; squares and hexagons, cold-rolled steel, 4.85c.; steel hoops, 1 in. and wider, No. 20 gage and heavier, 4.75c.; narrower than 1 in., all gages, 5.25c.; steel bands, No. 12 gage to ⅜-in., inclusive, 4.35c.; rails, 3.55c.; tool steel, 8.50c.; Norway iron, 7c.

Ore.—Last week's receipts of iron ore at this port included 15,380 tons from French Africa and 14,097 tons from Sweden, while 4000 tons of manganese ore from Brazil and 5047 tons from Turkey also arrived.

Coke.—There is an easier situation in blast furnace coke, with $4.50, Connellsville, now freely quoted, and it seemed likely today that even lower quotations could be obtained on prompt delivery fuel.

Old Material.—Scrap is in somewhat larger supply, due principally to the releasing of lots which scrap dealers have been holding in their yards. This, with the fact that there has been no increase in buying by consumers, has contributed to a weaker market and lower prices on some grades. There is difference of opinion among brokers as to what are the actual market prices today, the very limited volume of buying making it difficult to determine prices. Most of the prices below represent quotations which brokers would be willing to make, though it is doubtful whether these would hold on large tonnages. Most of the current business is in carload lots.

We quote for delivery at consuming points in this district as follows:

No. 1 heavy melting steel	$16.50 to $17.00
Scrap rails	16.00 to 16.50
Steel rails for rolling	19.00 to 19.50
No. 1 low phos., heavy 0.04 and under	23.00 to 24.00
Cast-iron car wheels	21.00 to 22.00
No. 1 railroad wrought	17.00 to 18.00
No. 1 yard wrought	18.00 to 18.50
No. 1 forge fire	14.00 to 15.00
Bundled sheets (for steel works)	14.00 to 15.00
No. 1 busheling	15.50 to 16.00
Mixed borings and turnings (for blast furnace use)	12.00 to 12.50
Machine shop turnings (for steel works use)	14.00 to 15.00
Machine shop turnings (for rolling mill use)	14.50 to 15.00
Heavy axle turnings (or equivalent)	15.00 to 15.50
Cast borings (for steel works and rolling mills)	15.50 to 16.00
Cast borings (for chemical plants)	17.00 to 17.50
No. 1 cast	21.00 to 21.50
Heavy breakable cast (for steel plants)	19.00 to 19.50
Railroad grate bars	17.50 to 18.00
Stove plate (for steel plant use)	17.50 to 18.00
Railroad malleable	20.00 to 21.00
Wrought iron and soft steel pipes and tubes (new specifications)	16.50 to 17.00
Shafting	24.00 to 25.00
Steel axles	22.00 to 23.00

Cleveland

Consumption of Ore Falls Off—Pig Iron Buying Mostly in Small Lots

CLEVELAND, Sept. 25.—With the curtailment of blast furnace operations, the consumption of Lake Superior ore fell off 394,209 gross tons during August, being 5,353,147 tons as compared with 5,747,356 tons in July, according to the monthly report of the Lake Superior Iron Ore Association. The peak was reached in May with the consumption of 6,118,540 tons. During August, 1922, the amount consumed was 2,589,-251 tons. Consumption by lake front furnaces including Canadian furnaces during August was 2,161,167 tons, a falling off of 62,127 tons. Interior furnaces in the central district consumed 2,763,533 tons during the month, a decline of 307,789 tons, or 10 per cent, and Eastern furnaces consumed 288,438 tons, a falling off of 15,770 tons. On Sept. 1 there was 32,831,227 tons of ore on hand at furnaces and Lake Erie docks as compared with 27,503,482 tons on Aug. 1 and with 37,630,-036 tons on Sept. 1, 1922. Stocks at furnaces Sept. 1 were 26,923,953 tons, as compared with 22,546,777 tons on Aug. 1.

Pig Iron.—The volume of business continues rather light and most sales are in small lots. Some consumers are buying only for immediate requirements and others for the remainder of the year. The Westinghouse Electric & Mfg. Co., which inquired for 7000 tons of foundry iron for its Cleveland and Trafford City plants, today purchased 200 tons for its Cleveland plant. This iron is understood to have gone to a Cleveland furnace at $26, delivered and apparently for deferred additional purchases. For out-of-town shipment, foundry and malleable iron are quoted at $25, which is also the more common price in the Valley and southern Ohio district, but quotations of $24.50 are still being made. The International Harvester Co. is credited with the purchase of 2400 tons of iron for its Springfield, Ohio, plant, 1200 tons of malleable iron from a Cleveland producer and 1200 tons of foundry iron from a southern Ohio furnace. One lake furnace, during the week, sold 4000 tons of foundry and malleable iron, all in small lots. Recent inquiries for iron for the first quarter resulted in three or four sales, aggregating 1200 tons, but new inquiry for that delivery has died out. Steel making iron is inactive. Some of the buyers of merchant basic iron are not consuming as much iron as they are receiving under their third quarter contracts. Low phosphorus iron has become more active. We note the sale of 1000 tons in several lots including one 500-ton lot in the Pittsburgh district, and another inquiry for 500 tons is pending. While standard low phosphorus iron is quoted at $30, some small lot sales have brought from $1 to $2 more. Southern foundry iron is weak. This is being offered at $21 for Tennessee iron, but Alabama furnaces seem to be holding to $23. The Otis Steel Co. will blow out one of its Cleveland stacks about Nov. 1 for relining.

Quotations below, except on basic and low phosphorus iron, are delivered Cleveland, and for local iron include a 50c. switching charge. Ohio silvery and Southern iron prices are based on a $3.02 freight rate from Jackson and $6 rate from Birmingham:

Basic, Valley furnace	$25.00
Northern No. 2 fdy., sil. 1.75 to 2.25	26.00
Southern fdy., sil. 1.75 to 2.25	28.00
Malleable	26.00
Ohio silvery, 8 per cent	37.52
Standard low phos., Valley furnace	30.00

Semi-Finished Steel.—Several leading producers are holding firmly to $42.50 for sheet bars and a northern Ohio consumer placed 500 tons for the fourth quarter with a Youngstown district mill at that price during the week, although a recent sale was reported at $40, Youngstown. Billets and slabs are weak and several quotations below the regular price have appeared, $40 Youngstown being the reported minimum. A Cleveland consumer has purchased 1200 tons of billets at a concession, the delivered price being reported to be close to $42.50.

Sheets.—New demand continues light and some of the independent mills have curtailed operations. A fair volume of business is coming from the automobile companies, but these are buying mostly in small lots. Prices are firm except on black sheets, which are being quoted freely at 3.75c. Automobile body sheets are moving fairly well.

Alloy Steel.—The demand shows an improvement as a result of orders that are coming from the automobile manufacturers. Prices are unchanged at the quotations that have prevailed for two months.

Reinforcing Bars.—Low prices continue on rail steel bars on which 2.25c. now appears to be the maximum quotation. The Truscon Steel Co. has taken 300 tons for the State Street viaduct, Akron.

Bolts, Nuts and Rivets.—The demand for bolts and nuts shows an improvement. Some of the large automobile companies have placed fourth quarter contracts and several inquiries are pending from railroads for that delivery. Specifications from automobile companies have increased. Local manufacturers are adhering to 60 and 5 per cent off list for large machine bolts and other regular prices, although some manufacturers are still quoting a 5 per cent additional discount. The new price lists become effective Oct. 1. Rivet orders show an improvement, but prices are not very firm. Quotations range from 2.90 to 3c. for structural rivets.

Finished Iron and Steel.—The volume of business shows little change. Sales are mostly in small lots for early requirements and mills continue to catch up on their order books. September business in this territory will be about the same in volume as that booked for August. Prices are firm at 2.40c. for steel bars and 2.50c. for plates and structural material. The only apparent weakness is on hot-rolled strip steel, which is quoted down to 2.75c. for wider sizes and around 3c. for the narrow material. In some cases, mills are quoting net prices on hot strips. Equipping motor cars with four wheel brakes is expected to increase considerably the demand for bands. The demand from manufacturers for plain wire is fairly heavy and many consumers have covered with fourth quarter contracts during the past week or two. The demand for steel pipe continues heavy. Automobile and parts manufacturers are buying steel a little more freely than they had been. The Willys-Overland Co. is placing 5000 to 6000 tons in bars and other products for the fourth quarter. While no rail inquiries have appeared, railroads in this territory expect to come in the market shortly for their 1924 requirements. Inquiries for two car ferries have come to lake shipyards from the Canadian National Railways. These will each require 2600 tons of plates and structural material.

Jobbers quote steel bars, 3.36c.; plates and structural shapes, 3.46c.; No. 9 galvanized wire, 3.70c.; No. 9 annealed wire, 3.25c.; No. 28 black sheets, 4.40c. to 4.65c.; No. 28 galvanized sheets, 5.50c. to 5.80c.; No. 10 blue annealed sheets, 3.75c. to 4.06c.; cold rolled rounds, 3.90c.; flats, squares and hexagons, 4.40c.; hoops and bands, 1 in. and wider and 20 gage or heavier, 4.16c.; narrower than 1 in. or lighter than No. 20 gage, 4.60c.

Coke.—Prices are unchanged at recent quotations and sales are limited to small lots for prompt shipment.

Old Material.—The downward movement of prices noted last week has continued and quotations on many grades have been reduced from 50c. to $1 per ton. The buying movement that dealers have been looking for has failed to materialize. While most consumers are taking scrap on contracts, one Youngstown mill has held up shipments and an embargo on scrap has been declared against a West Virginia steel plant.

We quote dealers' prices f.o.b. Cleveland per gross ton:

Heavy melting steel	$16.00 to $16.50
Rails for rolling	19.50 to 20.00
Rails under 3-ft	19.00 to 19.25
Low phosphorus melting	19.50 to 20.00
Cast borings	13.00 to 13.25
Machine shop turnings	12.50 to 13.00
Mixed borings and short turnings	12.50 to 13.00
Compressed sheet steel	15.00 to 15.50
Railroad wrought	15.00 to 15.25
Railroad malleable	22.75 to 23.00
Light bundled sheet stampings	12.00 to 12.50
Steel axle turnings	15.50 to 16.00
No. 1 cast	21.00 to 22.00
No. 1 busheling	12.00 to 12.50
Drop forge flashings	12.00 to 12.50
Railroad grate bars	17.00 to 17.50
Stove plate	16.00 to 17.00
Pipes and flues	12.50 to 13.00

British Iron and Steel Market

Japanese Still Buying Wire, Sheets and Plates—Pig Iron Easier—Tin Plate Bookings Heavy

(By Cable)

LONDON, ENGLAND, Sept. 25.

Demand for pig iron has improved, but makers are still prepared to reduce quotations for foundry iron if it will attract buyers. Dorman, Long & Co. and Bolckow, Vaughan & Co. have each blown out one furnace. No. 3 G. M. B. has sold in Scotland below 96s. ($21.66), f.o.b. Hematite iron is steady at present, but doubts are entertained as to whether the price can be maintained in the near future.

The foreign ore market is dull, with sellers of rubio at 22s. 6d. to 22s. 9d., ex-ship Tees.

The finished steel market is generally quiet, with little inclination on the part of mills to grant concessions. In some cases higher values are anticipated before long. The continental markets are firm, with an upward tendency, but sales are small except for wire, sheets and plates for Japan. India has also bought plates. The semi-finished steel market is irregular, with billets sold at little over £7 ($31.92), c.i.f. Wire rods are nominally £10 ($45.60), f.o.b.

In Belgium Soc. Anon. des Forges de Clabecq is erecting a third furnace and Soc. Anon. D'Athus Grivegne has relit a fourth furnace. Tin plates are firm, with a large business done in all sizes and most works fully booked to the end of October, with some already sold up for part of November and December. At a minimum price there are renewals for a further three months, and the question of a central selling agency has been referred to a committee. Galvanized sheets are steady, with a moderate demand for thick gages, but there is a large inquiry for thin specifications, especially for the Far East, with some makers sold out to the end of January. Demand for black sheets for the Far East continues, with works quoting Japan 6 x 3, 13s., 107 lb., up to £20 10s. ($91.20), f.o.b. May shipment.

We quote per gross ton, except where otherwise stated, f.o.b. makers' works, with American equivalent figured at $4.56 per £1, as follows:

Durham coke, delivered	£2	0s.	to	£2	1s.	$9.12	to	$9.21
Bilbao Rubio ore†	1	4				5.70		
Cleveland No. 1 foundry	5	2½				22.80		
Cleveland No. 3 foundry	4	16½	to	4	17	21.66	to	21.72
Cleveland No. 4 foundry	4	12				21.40		
Cleveland No. 4 forge	4	10				20.52		
Cleveland basic	5	0				22.80		
East Coast mixed	4	18½	to	5	0	21.79	to	22.80
Ferromanganese	18	0				82.08		
Ferromanganese*	18	10				84.36		
Rails, 60 lb. and up	8	0	to	9	0	36.48	to	41.04
Billets	7	10	to	8	5	34.20	to	36.62
Sheet and tin plate bars, Welsh	9	2½				41.60		
Tin plates, base box	1	3⅛	to	1	3¼	5.70	to	5.72
						C. per Lb.		
Ship plates	9	5	to	9	15	1.88	to	1.98
Boiler plates	12	10	to	13	0	2.54	to	2.64
Tees	9	15	to	10	5	1.98	to	2.08
Channels	9	0	to	9	10	1.83	to	1.93
Beams	8	15	to	9	5	1.78	to	1.88
Round bars, ¾ to 3 in.	10	15	to	11	5	2.18	to	2.29
Galvanized sheets, 24 g.	18	10	to	18	15	3.76	to	3.81
Black sheets, 24 gage	13	15				2.79		
Black sheets, Japanese specifications	15	5				3.10		
Steel hoops	12	0	&	12	10*	2.44	&	2.54*
Cold rolled steel strip, 20 gage	17	5				3.51		
Cotton ties, Indian specifications	15	0				3.05		

*Export price. †Ex-ship, Tees, nominal.

Continental Prices, All F. O. B. Channel Ports

Foundry pig iron:								
Belgium	£5	2½s.				$23.30	to	$23.90
France	5	2½				23.30	to	23.90
Luxemburg	5	2½				23.30	to	23.90
Billets:								
Belgium	6	12½	to	£7	0s.	30.10	to	31.80
France	6	12½	to	7	0	30.10	to	31.80
Merchant bars:						C. per Lb.		
Belgium	8	2½				1.65		
Luxemburg	8	2½				1.65		
France	7	10				1.53		
Belgium	£7	15				$1.57		
Belgium	7	15				1.59		
Luxemburg	7	12½				1.55		
France	7	10	to	7	12½	1.52	to	1.55
Angles:								
Belgium	8	0	to	8	5	1.63	to	1.68
⅛-in. plates:								
Belgium	8	5				1.68		
Germany	8	10				1.73		
¼-in. plates:								
Luxemburg	7	15				1.57		
Belgium	8	0				1.63		

Conditions in the Malleable Iron Industry

The demand for malleable castings shows little change in volume as compared with the few previous weeks, according to reports made at meetings of the American Malleable Castings Association at monthly meetings held last week. The Western members of the association met in Chicago, Sept. 19 and the Eastern members in New York, Sept. 21. Reports indicated that conditions in the malleable iron industry look somewhat brighter in the Central West than in the East. This is due to the demand for automobile castings which shows quite an improvement. The demand from the railroads is light, as new car work has not been coming out. There is very little demand from the implement manufacturers and few orders are being placed for miscellaneous castings. While the improvement so far has been limited to the automotive field, most of the foundrymen attending the meetings expressed the belief that considerable fall buying of castings in other fields would develop during the coming month.

New Books Received

Foundry Work. By R. E. Wendt. Pages 206, 4¼ x 7½ in.; illustrations, 172. Published by McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York. Price, $2.

Mechanics of Machinery; Mechanism. By Robert C. H. Heck. Pages 508, 5¾ x 9 in.; illustrations, 749. Published by McGraw-Hill Book Co., 370 Seventh Avenue, New York. Price, $5.

An Introduction to Mining Science. By J. B. Coppock and G. A. Lodge. Pages 252, 5 x 7¼ in.; illustrations, 102. Published by Longmans, Green & Co., 55 Fifth Avenue, New York. Price, $1.35.

The Chemical Resistance of Engineering Materials. By Marston Lovell Hamlin and Francis Mills Turner, Jr. Pages 267, 6 x 9 in.; illustrations, 21. Published by the Chemical Catalog Co., Inc., 19 East Twenty-fourth Street, New York. Price, $5.

Annual Report Chamber of Commerce of State of New York. Pages 465, 5¾ x 9 in.; illustrated. Published by Press of the Chamber of Commerce, 65 Liberty Street, New York.

J. B. Crane, sales manager of the George T. Ladd Co., Pittsburgh, addressed the M. E. Cooley Association No. 7, of the National Association of Stationary Engineers at Detroit, Sept. 6. His subject was "Large Water Tube Boilers." Mr. Crane is also scheduled for a talk on "Vertical vs. Horizontal Water Tube Boilers" at the next meeting of the Pittsburgh section No. 18 of the National Association of Stationary Engineers.

The M. A. Hanna Co., Cleveland, placed the 8-hr. day for continuous operations in effect at its Cherry Valley furnace, Leetonia, Ohio, and at its Detroit furnaces during the past week, increasing the hourly rate of the 8-hr. men 25 per cent. This company has not yet adopted the short hours for its Buffalo furnaces.

Automobile production in August, according to compilations of the Department of Commerce, amounted to 334,261 passenger cars and trucks against 327,508, the revised figure for July. The number of passenger cars made in August was 304,010 and in July 297,257.

THE SHORTER WORKDAY

Change Being Made in Finishing Mills of the Carnegie Steel Co.

PITTSBURGH, Sept. 24.—Application of the shorter workday in the steel industry steadily is being extended in the plants in this and nearby districts and no longer is being confined, as was the primary purpose of the plan, to the continuous process departments. Several finishing units of the Carnegie Steel Co. recently were put on the 8-hr. turn and it is probable that when the supply of workmen, particularly of the higher types of intelligence, is more ample than at present, not only will the 12-hr. day disappear from the blast furnaces, coke plants and steel works, but the 10-hr. day from the finishing mills. Getting sufficient men to fill the gaps created by the setting up of the third shift in the continuous process departments is one problem that has arisen to bother the plant managers and, as the change involved the promotion to responsible places of men before they were really qualified by experience for the new jobs, another problem will be bothersome until these men get "their feet on the ground."

The effort to fully eliminate the long workday is an earnest one on the part of plant officials, as is evident from recent efforts toward making the negro workmen useful employees. Some plant officials have found that the lack of ready money is one reason why there is such a heavy turnover among that class of men, and it also has been found that if these men can draw against their earnings at fairly frequent intervals they are more disposed to stay on the job than if paid only twice a month. Coming from Southern plantations without funds, they find it hard to get along for more than a few days, and the tendency among them is to leave the jobs they came to take and seek those where they can get paid promptly. It is believed that weekly paydays might solve the problem, and, while this would mean increasing the paymaster's force and the expense of this department, some argue that the higher cost would be counterbalanced by the smaller turnover among the colored men and less tendency among them to quit entirely upon receiving their semi-monthly pay.

At Merchant Stacks

Merchant pig iron producers are slow to move in eliminating the long workday. The Stewart Furnace Co., with a furnace at Sharon, Pa., near the plant of the Carnegie Steel Co., inaugurated the 8-hr. day along with the Carnegie company on Aug. 16, and the Sharpsville Furnace Co. recently posted notice that the 8-hr. day became effective on Sept. 16. These are the only merchant stacks in this and nearby districts which have adopted the new working schedule.

MORE COAL BURNED

National Association of Purchasing Agents Sees Increased Activity

The National Association of Purchasing Agents in its latest report on anthracite and bituminous coal takes an optimistic view of business conditions. It says in part:

"The most recent statistics covering the industrial consumption of hard and soft coal in the United States and Canada show that the volume of business, taken as a whole, recorded an increase during the month of August of 9.87 per cent, as compared with July.

"Business is looking up, and is well out of its backward and dormant state of the past few months. The month of August recorded considerable improvement, and the indications are that the upward swing which got its momentum during the month of August will continue.

"Of the total number of industrial coal consumers reporting for the month of August, 49 per cent recorded increases in business, 22 per cent remained stationary, and only 29 per cent showed further decreases, as compared with the preceding month. These percentages reflect a rather healthy condition, and are indicative of further progress and continued revival of business."

Statistics of the association include both bituminous and anthracite coal, and cover the total stocks in the hands of commercial consumers, the total tonnage consumed and the total production by months. (Coal consumed by the householder and his stocks are not included.)

Stocks on Hand	Net Tons
May 1, 1923	49,022,000
June 1, 1923	53,669,000
July 1, 1923	59,723,000
Aug. 1, 1923	66,937,000
Sept. 1, 1923	76,480,000
Consumption	
Month of April	43,659,000
Month of May	41,532,000
Month of June	39,720,000
Month of July	38,937,000
Month of August	42,750,000
Production	
Month of April	50,209,000
Month of May	54,735,000
Month of June	54,309,000
Month of July	53,062,000
Month of August	57,547,000

(Of the August production 48,864,000 tons were soft coal and 8,683,000 tons were hard coal.)

The figures shown for stocks and consumption are estimates, based on reports supplied by consumers.

The stocks of hard and soft coal in commercial consumers bins on Sept. 1 were 9,543,000 tons greater than on Aug. 1. Based on the rate of consumption in August the stocks on Sept. 1 were sufficient to meet the industrial requirements of the United States and Canada for a period of 55½ days on the average. Some consumers are exceptionally well supplied, while others have practically no reserves.

The association desires reports on stocks and consumption of coal from all industrial consumers, and is not confining its efforts to its membership, but asks that all who are willing to cooperate send the name of their purchasing agents.

Cost of Living Almost Stationary

From figures compiled by the National Industrial Conference Board it appears that the cost of living, based on the budget of the average workman, is practically stabilized at approximately 60 per cent above the pre-war level. Monthly figures, since May, 1921, have varied between 64.8 per cent excess as a maximum, and 54.5 per cent excess as a minimum, with an average for 27 months of 59.2 per cent above 1914. The figure for August at 61.6 per cent above 1914 is a slight recession from the 61.9 per cent of July. Both figures are higher than any other since the 62.7 per cent of December, 1921—that is, higher than anything in more than 18 months.

The change in the current month results from a decrease in food costs, partly counterbalanced by an increase in clothing costs; the other items were unchanged. Of all the items making up the present figures, food is by far the lowest, being listed at 46 per cent above the pre-war average. Clothing, sundries, shelter, and fuel and light are all above 70 per cent over pre-war, ranging in the order named from 71 to 76 per cent excess.

Domestic sales of oak leather belting in August, as reported by the Leather Belting Exchange, amounted to 446,258 lb., valued at $881,228, or an average of $1.97 per lb. This compares with 460,850 lb., $876,537 and $1.90 per lb. in the preceding month and with 590,618 lb., $967,433 and $1.64 per lb. in August, 1922. The increase in average price, since last year, has been 20 per cent. The returns are compiled from the reports of manufacturers representing about 60 per cent of the total product.

Prices Finished Iron and Steel f.o.b. Pittsburgh

Carload Lots

Plates

Sheared, tank quality, base, per lb.....2.50c.

Structural Materials

Beams, channels, etc., base, per lb.....2.50c.
Sheet piling .....2.65c.

Iron and Steel Bars

Soft steel bars, base, per lb.....2.40c.
Soft steel bars for cold finishing.....$3 per ton over base
Reinforcing steel bars, base.....2.40c.
Refined iron bars, base, per lb.....3.25c.
Double refined iron bars, base, per lb.....4.85c. to 5.00c.
Stay bolt iron bars, base, per lb.....8.00c. to 8.50c.

Hot-Rolled Flats

Hoops, ordinary gages and widths, base, per lb.....3.15c.
Bands, base, per lb.....3.15c.
Strips, base, per lb.....3.00c. to 3.15c.
Cotton ties, per bundle of 45 lb.....$1.62

Cold-Finished Steels

Bars and shafting, base, per lb.....3.25c.
Bars, S. A. E. Series, No. 2100.....4.50c. to 4.75c.
Bars, S. A. E. Series, No. 2300.....6.50c. to 6.75c.
Bars, S. A. E. Series, No. 3100.....5.50c. to 5.75c.
Strips, base, per lb.....5.00c.

Wire Products

Nails, base, per keg.....$3.00
Galvanized nails, 1 in. and over.....$2.25 over base
Galvanized nails, less than 1 in..... 2.50 over base
Bright plain wire, base, No. 9 gage, per 100 lb..... 2.75
Annealed fence wire, base, per 100 lb..... 2.90
Spring wire, base, per 100 lb..... 3.70
Galvanized wire, No. 9, base, per 100 lb..... 3.35
Galvanized barbed, base, per 100 lb..... 3.80
Galvanized staples, base, per keg..... 3.80
Painted barbed wire, base, per 100 lb..... 3.45
Polished staples, base, per keg..... 3.45
Cement coated nails, base, per count keg..... 2.70
Woven fence, carloads (to jobbers).....67½ per cent off list
Woven fence, carloads (to retailers).....65 per cent off list

Bolts and Nuts

Machine bolts, small, rolled threads,
60, 10 and 10 to 60, 10 and 5 per cent off list
Machine bolts, small, cut threads,
60 and 10 to 60 and 5 per cent off list
Machine bolts, larger and longer,
60 and 10 to 60 and 5 per cent off list
Carriage bolts, ⅝ x 6 in.:
Smaller and shorter, rolled threads,
60 and 10 to 60 and 5 per cent off list
Cut threads.....60 to 50, 10 and 5 per cent off list
Larger and longer.....60 to 50, 10 and 5 per cent off list
Lag bolts.....65 and 10 to 65 and 5 per cent off list
Plow bolts, Nos. 1, 2 and 3 heads....50 and 10 per cent off list
Other style heads.....20 per cent extra
Machine bolts, c.p.c. and t. nuts, ⅜ x 4 in.,
50 and 5 per cent off list
Larger and longer sizes.....50 and 5 per cent off list
Hot pressed square or hex. nuts, blank.....4.00c. off list
Hot pressed nuts, tapped.....4.00c. off list
C.p.c. and t. square or hex. nuts, blank.....3.75c. off list
C.p.c. and t. square or hex. nuts, tapped.....3.75c. off list
Semi-finished hex. nuts:
⅝ in. and smaller, U. S. S.....80 per cent off list
⅝ in. and larger, U. S. S.....75 per cent off list
Small sizes, S. A. E.....80 and 5 per cent off list
S. A. E., ⅝ in. and larger.....75 and 5 per cent off list
Stove bolts in packages.....75, 10 and 5 per cent off list
Stove bolts in bulk.....75, 10, 5 and 2½ per cent off list
Tire bolts .....60 and 10 per cent off list
Bolt ends with hot pressed nuts.....60 and 5 per cent off list
Turnbuckles, with ends, ½ in. and smaller,
55 and 5 to 50 per cent off list
Turnbuckles, without ends, ½ in. and smaller,
70 and 10 to 65 and 5 per cent off list
Washers .....5c. to 5.25c. off list

Cap and Set Screws

Milled square and hex. head cap screws....70 per cent off list
Milled set screws.....70 per cent off list
Upset cap screws.....75 and 10 per cent off list
Upset set screws.....75 and 10 per cent off list
Milled studs .....50 and 10 per cent off list

Rivets

Large structural and ship rivets, base, per 100 lb.$2.90 to $3.00
Small rivets .....65 and 10 off list

Track Equipment

Spikes, ⅜ in. and larger, base, per 100 lb..... $3.15
Spikes, ½ in., ⅝ in. and ¾ in., per 100 lb.....$3.15 to 3.50
Spikes, ⅞ in..... 3.15 to 3.50
Spikes, boat and barge, base, per 100 lb..... 3.50
Track bolts, ¾ in. and larger, base, per 100 lb..$4.00 to 4.25
Track bolts, ½ in. and ⅝ in., base, per 100 lb.. 5.00 to 5.50
Tie plates, per 100 lb..... 2.55 to 2.60
Angle bars, base, per 100 lb..... 2.75

Welded Pipe

Butt Weld

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
⅛	45	19½	⅛ to ⅜.....+11		+39
¼ to ⅜.....	51	25½	½	22	2
½	56	42½	¾	28	11
¾	60	48½	1 to 1½.....	30	13
1 to 3.....	62	50½			

Lap Weld

2	55	43½	2	23	7
2½ to 6.....	59	47½	2½	26	11
7 and 8.....	56	43½	3 to 6.....	28	13
9 and 10....	54	41½	7 to 12.....	26	11
11 and 12...	53	40½			

Butt Weld, extra strong, plain ends

⅛	41	24½	2 to 3.....	61	50½
¼ to ⅜.....	47	30½	¼ to ⅜.....+19		+54
½	53	42½	½	21	7
¾	58	47½	¾	28	12
1 to 1½.....	60	49½	1 to 1½.....	30	14

Lap Weld, extra strong, plain ends

2	53	42½	2	23	9
2½ to 4.....	57	46½	2½ to 4.....	29	15
4½ to 6.....	56	45½	4½ to 6.....	28	14
7 to 8.....	52	39½	7 to 8.....	21	7
9 and 10.....	45	32½	9 to 12.....	16	2
11 and 12....	44	31½			

To the large jobbing trade the above discounts are increased by one point, with supplementary discounts of 5 per cent on black and 1½ points, with a supplementary discount of 5 per cent on galvanized.

Boiler Tubes

Lap Welded Steel		*Charcoal Iron*	
2 to 2¼ in.....	27	1½ in. .....+18	
2½ to 2¾ in.....	37	1⅞ to 1⅞ in.....+ 8	
3 in.	40	2 to 2¼ in.....— 2	
3¼ to 3¾ in.....	42½	2½ to 3 in.....— 7	
4 to 13 in.....	46	3¼ to 4½ in.....— 9	

Less carload lots 4 points less.

Standard Commercial Seamless Boiler Tubes

Cold Drawn			
1 in.	55	3 and 3¼ in.....	36
1¼ and 1½ in.....	47	3½ and 3¾ in.....	37
1¾ in.	31	4 in.	41
2 and 2¼ in.....	22	4½ in. and 5 in.....	33
2½ and 2¾ in.....	32		
Hot Rolled			
3 and 3¼ in.....	38	4 in.	43
3½ in. and 3¾ in....	39		

Less carloads, 4 points less. Add $8 per net ton for more than four gages heavier than standard. No extras for lengths up to and including 24 ft. Sizes smaller than 1 in. and lighter than standard gage to be sold at mechanical tube list and discount. Intermediate sizes and gages not listed take price of net larger outside diameter and heavier gage.

Seamless Mechanical Tubing

Carbon under 0.30, base.....83 per cent off list
Carbon 0.30 to 0.40, base.....81 per cent off list

Plus usual differentials and extras for cutting. Warehouse discounts range higher.

Seamless Locomotive and Superheater Tubes

Cents per Ft.		Cents per Ft.	
2-in. O.D. 12 gage....	15	2¼-in. O.D. 10 gage..	20
2-in. O.D. 11 gage....	16	3-in. O.D. 7 gage.....	35
2-in. O.D. 10 gage....	17	1½-in. O.D. 9 gage...	15
2¼ in. O.D. 12 gage..	17	5⅜-in. O.D. 9 gage...	55
2¼-in. O.D. 11 gage..	18	5½-in. O.D. 9 gage...	57

Tin Plate

Standard cokes, per base box.....$5.50

Terne Plate

(Per Package, 20 x 28 in.)

8-lb. coating, 100 lb. base $11.00		20-lb. coating I. C....$14.90	
8-lb. coating I. C....	11.30	25-lb. coating I. C....	16.20
12-lb. coating I. C....	12.70	30-lb. coating I. C....	17.35
15-lb. coating I. C....	13.95	35-lb. coating I. C....	18.35
		40-lb. coating I. C....	19.35

Sheets

Blue Annealed

Nos. 9 and 10 (base), per lb.....3.00c.

Box Annealed, One Pass Cold Rolled

No. 28 (base), per lb.....3.75c. to 3.85c.

Automobile Sheets

Regular auto body sheets, base (22 gage), per lb.....5.35c.

Galvanized

No. 28 (base), per lb.....5.00c.

Long Ternes

No. 28 gage (base), 8-lb. coating, per lb.....5.30c.

Tin-Mill Black Plate

No. 28 (base), per lb.....3.85c.

Freight Rates

All freight rates from Pittsburgh on finished iron and steel products, carload lots, per 100 lb.:

Philadelphia, domestic.	$0.32	Buffalo	$0.265	St. Louis	$0.43
Philadelphia, export...	0.235	Cleveland	0.215	Kansas City	0.735
Baltimore, domestic...	0.31	Cleveland, Youngstown Comb.	0.19	Kansas City (pipe)...	0.705
Baltimore, export	0.225	Detroit	0.29	St. Paul	0.60
New York, domestic...	0.34	Cincinnati	0.29	Omaha	0.735
New York, export.....	0.255	Indianapolis	0.31	Omaha (pipe)	0.705
Boston, domestic.....	0.365	Chicago	0.34	Denver	1.27
Boston, export.....	0.255			Denver (pipe)	1.215
				Pacific Coast	$1.34
				Pac. Coast, ship plates	1.20
				Birmingham	0.58
				Memphis	0.56
				Jacksonville, all rail..	0.70
				Jacksonville, rail and water	0.415
				New Orleans	0.67

The minimum carload to most of the foregoing points is 6000 lb. To Denver the minimum loading is 40,000 lb., while the rate applies to a minimum of 50,000 lb., and there is an extra charge of 9c. per 100 lb. on carloads of a minimum of 40,000 lb. On shipments of wrought iron and steel pipe to Kansas City, St. Paul, Omaha and Denver the minimum carload is 46,000 lb. On iron and steel items not noted above the rates vary somewhat and are given in detail in the regular railroad tariffs.

Rates from Atlantic Coast ports (i.e., New York, Philadelphia and Baltimore) to Pacific Coast ports of call on most steamship lines, via the Panama Canal, are as follows: Pig iron, 35c.; ship plates, 40c.; ingot and muck bars, structural steel, common wire products including cut or wire nails, spikes, and wire hoops, 40c.; sheets and tin plates, 40c.; sheets, No. 12 gage and lighter, 50c.; rods, 40c.; wire rope cables and strands, 45c.; wire fencing, netting and stretcher, 40c.; pipes not over 12 in. in diameter, 55c.; over 12 in. in diameter, 2½c. per in. or fraction thereof additional. All prices per 100 lb. in carload lots, minimum 40,000 lb.

Prices of Raw Materials, Semi-Finished and Finished Products

Ores

Lake Superior Ores, Delivered Lower Lake Ports

Old range Bessemer, 55 per cent iron	$6.45
Old range non-Bessemer, 51½ per cent iron	5.70
Mesabi Bessemer, 55 per cent iron	6.20
Mesabi non-Bessemer, 51½ per cent iron	5.55

Foreign Ore, per Unit, c.i.f. Philadelphia or Baltimore

Iron ore, low phos., copper free, 55 to 58 per cent iron in dry Spanish or Algerian	11½c.
Iron ore, Swedish, average 66 per cent iron	10.50c.
Manganese ore, washed, 51 per cent manganese, from the Caucasus, nominal	43c.
Manganese ore, ordinary, 48 per cent manganese, from the Caucasus	41c.
Manganese ore, Brazilian or Indian, nominal	42c.
Tungsten ore, per unit, in 60 per cent concentrates	$8.25 to $10.00
Chrome ore, basic, 48 per cent Cr_2O_3, crude, per ton, c.i.f. Atlantic seaboard	18.00 to 28.00
Molybdenum ore, 85 per cent concentrates, per lb. of MoS_2, New York	75c. to 85c.

Ferroalloys

Ferromanganese, domestic, 80 per cent, furnace, or seaboard, per ton	$110.00
Ferromanganese, British, 80 per cent, f.o.b. Atlantic port, duty paid	$108.00 to 110.00
Spiegeleisen, domestic, 19 to 21 per cent, per ton, furnace	45.00
Spiegeleisen, domestic, 16 to 19 per cent, furnace, per ton	44.00
Ferrosilicon, 50 per cent, delivered, per gross ton	82.50
Ferrosilicon, Bessemer, 10 per cent, per ton, furnace	43.50
Ferrosilicon, Bessemer, 11 per cent, per ton, furnace	46.80
Ferrosilicon, Bessemer, 12 per cent, per ton, furnace	50.10
Ferrosilicon, Bessemer, 13 per cent, per ton, furnace	54.10
Ferrosilicon, Bessemer, 14 per cent, per ton, furnace	59.10
Silvery iron, 6 per cent, per ton, furnace	32.00
Silvery iron, 7 per cent, per ton, furnace	33.00
Silvery iron, 8 per cent, per ton, furnace	34.50
Silvery iron, 9 per cent, per ton, furnace	36.50
Silvery iron, 10 per cent, per ton, furnace	38.50
Silvery iron, 11 per cent, per ton, furnace	41.80
Silvery iron, 12 per cent, per ton, furnace	45.10
Ferrotungsten, per lb. contained metal	88c. to 90c.
Ferrochromium, 4 to 6 per cent carbon, 60 to 70 per cent Cr. per lb. contained Cr. delivered	12c.
Ferrochromium, 6 to 7 per cent carbon, 60 to 70 per cent Cr., per lb.	11.50c.
Ferrovanadium, per lb. contained vanadium	$3.50 to $4.00
Ferrocarbontitanium, 15 to 18 per cent, per net ton	200.00

Fluxes and Refractories

Fluorspar, 80 per cent and over calcium fluoride, not over 5 per cent silica, per net ton f.o.b. Illinois and Kentucky mines	$22.00
Fluorspar, 85 per cent and over calcium fluoride, not over 5 per cent silica, per net ton f.o.b. Illinois and Kentucky mines	23.50

Per 1000 f.o.b. works:

Fire Clay:	High Duty	Moderate Duty
Pennsylvania	$45.00 to $48.00	$40.00 to $45.00
Maryland	50.00	45.00
Ohio	45.00 to 46.00	40.00 to 42.00
Kentucky	45.00 to 46.00	40.00 to 42.00
Illinois	——	40.00 to 45.00
Missouri	45.00 to 48.00	38.00 to 43.00
Ground fire clay, per net ton		6.50 to 7.50
Silica Brick:		
Pennsylvania		42.00 to 45.00
Chicago		52.00
Birmingham		53.00
Ground silica clay, per net ton		9.00
Magnesite Brick:		
Standard size, per net ton (f.o.b. Baltimore and Chester, Pa.)		65.00
Grain magnesite, per net ton (f.o.b. Baltimore and Chester, Pa.)		40.00
Chrome Brick:		
Standard size, per net ton		50.00

Semi-Finished Steel, f.o.b. Pittsburgh or Youngstown, per gross ton

Rolling billets, 4-in. and over	$40.00 to $42.50
Rolling billets, 2-in. and under	40.00 to 42.50
Forging billets, ordinary carbons	47.50
Sheet bars, Bessemer	$40.00 to 42.50
Sheet bars, open-hearth	40.00 to 42.50
Slabs	$42.50
Wire rods, common soft, base, No. 5 to ¼-in.	51.00
Wire rods, common soft, coarser than ¼-in.	$2.50 over base
Wire rods, screw stock	$5 per ton over base
Wire rods, carbon 0.20 to 0.40	3 per ton over base
Wire rods, carbon 0.41 to 0.55	5 per ton over base
Wire rods, carbon 0.56 to 0.75	7.50 per ton over base
Wire rods, carbon over 0.75	10 per ton over base
Wire rods, acid	15 per ton over base
Skelp, grooved, per lb.	2.40
Skelp, sheared, per lb.	2.40
Skelp, universal, per lb.	2.40

Finished Iron and Steel, f.o.b. Mill

Rails, heavy, per gross ton	$43.00
Rails, light, new steel, base, per lb.	2.25c.
Rails, light, rerolled base, per lb.	1.90c. to 2.00c.
Spikes, ⅝-in. and larger, base, per 100 lb.	$3.15
Spikes, ½-in., ⅜-in. and ⅝-in., base per 100 lb.	$3.15 to 3.50
Spikes, ⅜-in., base, per 100 lb.	3.15 to 3.50
Spikes, boat and barge, base, per 100 lb.	3.50
Track bolts, ⅝-in. and smaller, base, per 100 lb.	4.15 to 4.25
Track bolts, ¾-in. and larger, base, per 100 lb.	4.75 to 5.50
Tie plates, per 100 lb.	2.55 to 2.60
Angle bars, per 100 lb.	2.75
Bars, common iron, base, per lb., Chicago mill	2.50c.
Bars, common iron, Pittsburgh mill	2.40c.
Bars, rails, steel reinforcing, base, per lb.	2.15c. to 2.25c.
Ground shafting, base, per lb.	3.65c.
Cut nails, base, per keg	$3.15 to $3.25

S. A. E. Semi-finished Castellated Nuts and U. S. S. Semi-finished Slotted Nuts

(To jobbers and consumers in large quantities f.o.b. Pittsburgh.)

	Per 1000 S. A. E.	Per 1000 U. S. S.
¼-in.	$ 4.80	$ 4.80
5/16-in.	5.50	6.00
⅜-in.	6.50	7.00
7/16-in.	9.00	9.50
½-in.	11.00	11.50
9/16-in.	15.00	15.00
⅝-in.	19.50	20.00
¾-in.	28.50	28.50
⅞-in.	37.00	37.50
1-in.	58.50	60.50
1⅛-in.	88.00	97.00
1¼-in.	132.00	132.00
1⅜-in	176.00	176.00
1½-in.	220.00	220.00

Larger sizes—Prices on application

Alloy Steel

S.A.E. Series Numbers	Bars 100 lb.
2100*(½% Nickel, 10 to 20 per cent Carbon)	$3.25 to $3.50
2300 (3½% Nickel)	5.25 to 5.50
2500 (5% Nickel)	7.75 to 8.00
3100 (Nickel Chromium)	4.25 to 4.50
3200 (Nickel Chromium)	6.00 to 6.25
3300 (Nickel Chromium)	8.00 to 8.25
3400 (Nickel Chromium)	7.00 to 7.25
5100 (Chromium Steel)	3.75 to 4.00
5200*(Chromium Steel)	8.00 to 8.25
6100 (Chromium Vanadium bars)	5.00 to 5.25
6100 (Chromium Vanadium spring steel)	4.75 to 5.00
9250 (Silico Manganese spring steel)	3.75 to 4.00
Nickel Chrome Vanadium (0.60 Nickel, 0.50 Chromium, 0.15 Vanadium)	5.25 to 5.50
Chromium Molybdenum bars (0.80—1.10 Chromium, 0.25—0.40 Molybdenum)	4.50 to 4.75
Chromium Molybdenum bars (0.50—0.70 Chromium, 0.15—0.25 Molybdenum)	4.25 to 4.50
Chromium Molybdenum spring steel (1—1.25 Chromium, 0.30—0.50 Molybdenum)	4.25 to 4.50

Above prices are for hot-rolled alloy steel bars, forging quality, per 100 lb. f.o.b. Pittsburgh. Billets 4 x 4 in. and larger are $10 per gross ton less than net ton price for bars of same analyses. On smaller than 4 x 4-in. billets down to and including 2½-in. sq. there is a size extra of $10 per gross ton; on billets smaller than 2½-in. sq., the net ton bar price applies.

*Not S.A.E. specifications, but numbered by manufacturers to conform to S.A.E. system.

FABRICATED STEEL BUSINESS

Orders for Tanks Feature the Week's Awards—Inquiries Nearly Equal Last Week's

The largest awards for tanks in many weeks, amounting to 14,000 tons, is the feature of structural lettings. Private and public building awards have fallen off and total less than 10,000 tons. New inquiries have dropped to about 17,000 tons, against 19,000 tons a week ago.

Jamaica Bay Boulevard viaduct, 200 tons, to American Bridge Co.

Henry L. Doherty & Co., New York, 400 tons, to Kansas City Structural Co.

Apartment building at 15 Park Avenue, New York, 650 tons, to Taylor-Fichter Steel Construction Co.

Apartment building at Fifth Avenue and Tenth Street, New York, 525 tons, to Taylor-Fichter Steel Construction Co.

Garage for John D. Rockefeller, Jr., 150 tons, to Hedden Iron Construction Co.

Golding apartment building, New York, 400 tons, to Hinkle Iron Co.

The Pan-American Petroleum Co., 13 100,000-bbl. tanks and 2 80,000-bbl. tanks, 6000 tons, to Chicago Bridge & Iron Works.

The Graver Corporation, Chicago, has taken the following orders for oil storage tanks: 1200 tons for the Invincible Oil Co., 600 tons for the Utah Oil Co., 3200 tons for the Independent Oil & Gas Co., the Delmar Oil Co., the Simpson Fell Co. and the Burt-Franklin Co., all four of which are controlled by the same interests, and 3000 tons for miscellaneous orders from California.

Alvernia High School building, Chicago, 538 tons, to Duffin Iron Works.

State Teachers College building, Winona, Minn., 160 tons, to St. Paul Structural Steel Co.

Hermitage Portland Cement Co., plant, Nashville, Tenn., 112 tons, to Nashville Bridge Co.

Michigan State Highway Commission, bridge at Grand Haven, 650 tons, to Wisconsin Bridge & Iron Co.

Milwaukee Coke & Gas Co., reconstruction of benzol plant, 250 tons, to Wisconsin Bridge & Iron Co.

Nash Motors Co., shipping building at Milwaukee works, 250 tons, to Worden-Allen Co.

Wisconsin State Highway bridge at Peshtigo, Wis., 178 tons; general contractor, Stein Construction Co., Milwaukee, to sublet steel.

Gas holder, San Diego, Cal., 1200 tons, to Stacey Mfg. Co.

Knights of Columbus Club, Rochester, N. Y., 1800 tons, to Genesee Bridge Co.

Diamond Alkali Co., extension, Painesville, Ohio, 700 tons, to McClintic-Marshall Co.

American Sintering Co., Hubbard, Ohio, 600 tons, reported placed with Penn Bridge Co.

Structural Projects Pending

Inquiries for fabricated steel work include the following:

Virginian Railway, bridges, 200 tons.

Transit Commission, New York, subway work in Fourth Avenue, Brooklyn, 3000 tons.

Central Railroad of New Jersey, bridges, 200 tons.

Philadelphia & Reading Railroad, bridges, 200 tons.

Central Steel & Wire Co., Chicago, addition, 400 tons.

Knights of Columbus club house, Madison Street and Cicero Avenue, Chicago, 1450 tons instead of 600 tons as reported last week.

Compania Carbonifera de Sabinas, Rosita, Mexico, washer building and conveyor frames, 450 tons, Allen & Garcia, Chicago, engineers.

John B. Murphy Memorial Auditorium, Chicago, 300 tons.

Illinois Central, an 85-ft. and two 50-ft. deck plate girder spans for Madisonville, Ky., 135 tons.

Elks Club building, Gary, Ind., 350 tons.

School, Columbus, Ohio, 350 tons, bids to be taken about Oct. 1.

Portsmouth, Ohio, hotel, 300 tons, postponed.

Twin Branches power plant, Mishawaka, Ind., 4000 tons.

Ford Motor Co., assembling plant at Philadelphia, 5000 tons.

Bell Telephone Co., Philadelphia, exchange, 400 tons.

Crosswick bridge, Bordentown, N. J., 160 tons; Phoenix Iron Co., low bidder.

Babes and Children's Hospital, Cleveland, 1000 tons.

RAILROAD EQUIPMENT BUYING

Inquiries for Over 100 Passenger Cars—No Orders Placed for Cars or Locomotives

With no orders for cars or locomotives reported, this week's business is confined to moderate inquiries, the largest of which is 60 passenger cars for the Long Iland Railroad and 50 for the Central of New Jersey. A Chinese inquiry involves 50 flat cars. Repair work is also limited.

The Long Island Railroad is in the market for 60 motor passenger cars.

The Central Railroad of New Jersey is inquiring for 15 steel passenger cars, 5 steel combination cars and 10 steel baggage cars.

The Philadelphia & Reading is in the market for 10 steel combination cars.

The American Window Glass Co. has let contract for the repair of 30 hopper cars to the Pressed Steel Car Co.

The Northern Pacific is inquiring for 10 center sills.

An inquiry from China calls for 50 flat cars.

The Philadelphia & Reading is in the market for 40 suburban coaches and 10 combination suburban coaches and baggage cars.

The Central Railroad of New Jersey is inquiring for 50 coaches, 5 combination passenger and baggage and 10 baggage cars.

More Men Than Jobs in Philadelphia—Demand in Pittsburgh Active

HARRISBURG, PA., Sept. 24.—For the first time this year, according to the semi-monthly report of the Philadelphia employment office to DR. Royal Meeker, State Secretary of Labor and Industry, there is a surplus of first-class iron and steel plant machinists in the district. This was indicated recently by the arrival of an employment agent to secure tool and die makers and general machinists. Almost 75 per cent of the men paid their own carfare. Molders and pattern makers are still scarce.

The Pittsburgh office reports openings for practically all kinds of workmen, and no early change in the conditions in general is expected. The demand for all class of workmen continues relatively good.

Iron and steel plants in the Erie district are operating at 94 per cent of capacity, according to a survey just completed. The supply and demand for virtually all class of skilled mechanics are reported equal.

Marked improvement is reported to have been shown in all departments and branches of the iron and steel trades in the Harrisburg district. Skilled, semi-skilled and unskilled mill workers are widely sought. Johnstown mills are reported to be producing a satisfactory output.

Moderate Improvement in Youngstown but Buyers Are Very Cautious

YOUNGSTOWN, Sept. 25.—Orders do not measure up to shipments, is a fair summarization of the iron and steel market situation in this district. The declining rate of finishing mill operations is also indicative of the situation. Steel makers are not pessimistic in making such statements, but are simply reporting current buying conditions as they actually exist.

The hopeful aspect of the situation is that steel stocks in hands of jobbers and consumers appear to be much below the usual inventory and current buying largely confined to actual requirements.

"Stocks of iron and steel in the hands of jobbers and users are low," states President James A. Campbell of the Youngstown Sheet & Tube Co. "Nobody is buying ahead and this is one of the principal reasons why the industry is not up to the mark of the usual fall buying. Everybody seems to be waiting."

Mr. Campbell states that while business is still quiet, new orders are more numerous and involve larger tonnages than ruled during July and August. Production is being fairly well sustained, though curtailment in finishing mill schedules is already in effect.

NON-FERROUS METALS

The Week's Prices

Cents per Pound for Early Delivery

	Copper, New York		Straits Tin	Lead		Zinc	
Sept.	Lake	Electrolytic*	New York	New York	St. Louis	New York	St. Louis
19.....	13.75	13.25	41.37½	7.10	6.75	6.75	6.40
20.....	13.75	13.12½	41.25	7.10	6.75	6.75	6.40
21.....	13.75	13.00	41.00	7.10	6.75	6.75	6.40
22.....	13.75	13.00	....	7.10	6.75	6.75	6.40
24.....	13.75	13.12½	42.00	7.10	6.75	6.75	6.40
25.....	13.87½	13.25	42.25	7.10	6.75	6.77½	6.42½

*Refinery quotation; delivered price ¼c. higher.

New York

NEW YORK, Sept. 25.

None of the markets is particularly active. After lower prices there has been a fair demand for copper. The lead market is moderately active and steady. There has been no improvement in the demand for zinc, with the market practically stationary.

Copper.—The electrolytic copper market fell until the middle of last week, when moderately large sales were made at 13.25c. to 13.37½c., delivered. Today it is believed that nearly all metal below 13.50c., delivered, has been absorbed and the minimum of the market is regarded as 13.25c., refinery, or 13.50c., delivered. Some sellers are out of the market at anything less than 13.62½c., delivered. There is a fair amount of inquiry before sellers, but consumers do not report any marked improvement in demand for finished products. Lake copper is quoted at 13.75c. to 14c., delivered.

Tin.—Buyers and sellers have assumed a waiting attitude and the market had been very dull up to yesterday, when 200 to 250 tons of Straits tin changed hands. It was made up of both nearby delivery and far-off shipment, with most of the sales made at 42c., although one parcel brought 42.10c. The only feature of interest during the week was the eagerness of one large importer for orders. The market here today has been very dull, with spot Straits tin quoted at 42.25c., New York. In the London market quotations today were £3 to £5 per ton higher than a week ago, with spot standard quoted at £203 5s., future standard at £202 17s. 6d., and spot Straits at £206 15s. Arrivals thus far this month have been 3230 tons, with 5035 tons reported afloat.

Lead.—This market is quieter, with a slight easing in prices. There is less of a scarcity of prompt lead, which is slightly easier at 6.75c., St. Louis, or 7.10c., New York. A week ago there were bids for prompt lead at 6.75c., St. Louis. While the market is not exactly firm it may be regarded as steady and good business is looked for in the immediate future, with practically little shrinkage in prices.

Zinc.—Demand from galvanizers or brass melters is inconsequential, but there have been fair sales for export to England and there is still some foreign inquiry before the market. Prices have been slightly lower than a week ago, with early or October delivery quoted at 6.42½c., St. Louis, or 6.77½c., New York, for prime Western.

Nickel.—Shot and ingot nickel are quoted unchanged at 29c. to 32c. per lb., with the electrolytic nickel held at 32c. by the leading producers. In the outside spot market quotations for both shot and ingot nickel are 29c. to 32c. per lb.

Antimony.—Wholesale lots of Chinese metal for early delivery are quoted at 7.50c., New York, duty paid.

Aluminum.—Virgin metal, 98 to 99 per cent pure, is quoted by importers at 26.50c., New York, duty paid, in such cases where they can obtain it from foreign producers. There have been some fair-sized inquiries for fourth quarter and first quarter delivery. No quotations are made public by the leading domestic producer.

Old Metals.—Business continues quiet and the market shows little change. Dealers' selling prices are as follows:

	Cents Per Lb.
Copper, heavy and crucible	13.50
Copper, heavy and wire	12.50
Copper, light and bottoms	10.75
Heavy machine composition	10.75
Brass, heavy	7.75
Brass, light	6.25
No. 1 red brass or composition turnings	8.75
No. 1 yellow rod brass turnings	7.00
Lead, heavy	6.50
Lead, tea	5.50
Zinc	5.00
Cast aluminum	16.75
Sheet aluminum	16.75

Chicago

SEPT. 25.—Tin has advanced as a result of a shortage in London, while lead and zinc have declined, there being larger offerings of those metals than purchases. Copper shows a slightly better tone, with price unchanged. Among the old metals, tin grades have advanced. We quote in carload lots, Lake copper, 14.50c.; tin, 43c.; lead, 6.75c.; spelter, 6.45c.; antimony, 9c., in less than carload lots. On old metals we quote copper wire, crucible shapes and copper clips, 11c.; copper bottoms, 9.50c.; red brass, 8.50c.; yellow brass, 6c.; lead pipe, 5.25c.; zinc, 4.25c.; pewter, No. 1, 22c.; tin foil, 30c.; block tin, 35c.; all buying prices for less than carload lots.

Operating Schedules Reduced in the Mahoning Valley

YOUNGSTOWN, Sept. 25.—Reductions this week in operating schedules of Mahoning Valley plants are but the forerunners of other curtailments, unless new business comes forward in larger volume, say steel makers. Because of the general slackness in the black sheet market, the Falcon Steel Co. was obliged to suspend its 8-mill plant at Niles. The Falcon Tin Plate Co., an allied interest, is operating seven of nine tin plate mills at Canton.

The Mahoning Valley Steel Co. is operating six mills this week, at its sheet mill plant in Niles, a reduction of one unit. Of the 117 sheet and jobbing mills in the Mahoning Valley, 75 were scheduled for operation on Monday.

The Republic Iron & Steel Co. has likewise suspended two merchant bar mills, leaving two active mills of the five at the Brown-Bonnell works in Youngstown.

Of the 17 tube mills in the Valley, 16 are operating, the Youngstown Sheet & Tube Co. having 10 of its 11 units active, and the Republic company all six of its pipe mills.

The steel department at New Castle, Pa., of the Carnegie Steel Co. has been put on a five-day basis, instead of six days as heretofore.

Forty-four independent open-hearth furnaces are melting in the Mahoning Valley, with little change in this branch of steel-making.

The Trumbull Steel Co., Warren, has added one jobbing mill to its inactive list, which includes in addition four tin plate units.

At the combined meeting of the Engineers' Club of Cincinnati and the Cincinnati Section of the A. S. M. E., held at the Chamber of Commerce, Sept. 20, Col. C. W. Kutz, division engineer, Central Division Corps of Engineers, U. S. A., and C. I. Grimm, assistant engineer, described the progress being made on the survey for the proposed deep water barge canal to connect the Ohio River and Lake Erie. These preliminary surveys of proposed routes will probably be completed by Jan. 1. Colonel Kutz gave some figures which would indicate the quantity of steel required. For Route No. 4, Cincinnati to Toledo, 194 bridges would be required; Route 1, Pittsburgh to Ashtabula, 89 bridges, and Route 3, Sandusky to Portsmouth, 86 bridges. The cost of the canal from Sandusky to Portsmouth has been estimated at $150,000,000.

PERSONAL

Harry J. Bailey, who on Aug. 25 was elected president of the Consolidated Machine Tool Corporation, succeeding the late W. H. Marshall, has been engaged in the machine-tool business since 1899, when he started his career as messenger boy for the former Hilles & Jones Co., Wilmington, Del. He worked his way through the plant as salesman, purchasing agent, secretary, and finally president of the company. He was elected secretary in 1900 and in 1918 succeeded to the presidency. When the Hilles & Jones works became a part of the Consolidated Machine Tool Corporation, Mr. Bailey became vice-president of the latter corporation in charge of operations at the Hilles & Jones plant. He has been actively connected with the machine-tool business for 24 years, his present age being 48. He will reside in Rochester, N. Y., where the general offices of the Consolidated corporation are now located.

HARRY J. BAILEY

M. F. Day, Jr., who for the past few months has represented Rogers, Brown & Co. at Chicago, is no longer associated with that firm.

United States Marshal McGregor of Pittsburgh has been ordered by the United States District Court to sell on Oct. 23 the plant of the Sharon Pressed Steel Co., Sharon, Pa., which was involved in the Cleveland Discount Co. failure. It is said that the Discount company had advanced around $2,000,000 on payroll requirements.

George R. Woods, manager in New York of Stockvis & Zonen, 17 Battery Place, who deal in machine tools, has returned from a sojourn in Quebec.

H. E. Baldwin has resigned as chief engineer of the Variety Iron Works Co., Cleveland, to take a similar position with the Brown Hoisting Machinery Co., that city. He was associated with the engineering department of the latter company about 15 years ago.

Richard M. Haskins, erecting engineer, Bucyrus Co., South Milwaukee, Wis., and Mrs. Haskins arrived in Milwaukee on Sept. 21, the first survivors of the Japanese disaster to reach that city. Mr. Haskins was seriously injured and is confined in Columbia Hospital, having also found it necessary to have hospital treatment at Vancouver, B. C., upon arrival there Sept. 16. Mr. and Mrs. Haskins were in the Oriental Palace Hotel, Yokohama, at the time of the catastrophe. Mrs. Haskins escaped with slight injuries.

M. J. Sylvester, superintendent of forge and projectile machine shops, Bethlehem Steel Co., Bethlehem, Pa., has been appointed superintendent of the general machine shops and founders at the plant, in addition to his present duties, succeeding in the latter capacity John M. Lund, resigned.

W. A. Carrell, vice president and general manager Erd Motors Corporation, Saginaw, Mich., has been elected president to succeed the late F. Erd. He was connected previously with the Wisconsin Motors Co. for several years, acting as general manager.

Newman M. Marsilius, general manager Woodstock Typewriter Co., Woodstock, Ill., has resigned, effective Oct. 1, to go with another company.

Lewis D. McClaren, sales manager United Coke & Coal Co., Fisher Building, Chicago, has been promoted to vice-president.

William A. Rogers, Rogers, Brown & Co., Buffalo, will sail on Oct. 2 to spend several months in India, Ceylon and Siam.

Robert D. Black, branch manager for the Black & Decker Mfg. Co., in charge of the Philadelphia territory, will return to headquarters about the middle of November to take up duties as advertising manager for the company. H. G. Smith, present resident salesman for Pittsburgh and Western Pennsylvania, will succeed Mr. Black. E. D. Allmendinger, formerly working in the Detroit territory, has returned to headquarters at Towson, Baltimore, where he will take charge of the Black & Decker export business.

George W. Tyrol, formerly with J. H. Williams & Co., has joined the sales force of the Bonney Forge & Tool Works, Allentown, Pa., and will cover Pennsylvania, Southern New York, New Jersey and Delaware.

James W. Hook, who for the past six years has been president of the Allied Machinery Co. of America, has resigned that position to enter the manufacturing field. After graduating from Iowa State College, Ames, Iowa, Mr. Hook was with the Globe Machinery & Supply Co., Des Moines, Iowa, as engineer for two years, leaving there in 1908 when appointed sales manager of C. A. Dunham Co., Marshalltown, Iowa, later becoming general manager of that company. In 1916 he left to become associated with the Allied Machinery Co. of America, and was elected president the following year. On Oct. 1 Mr. Hook will take up his duties as vice-president and general manager of the Geometric Tool Co., New Haven, Conn., manufacturer of die heads and other threading devices.

JAMES W. HOOK

Lloyd Booth, president Falcon Steel Co., Niles, Ohio, back from a trip to Europe, declares conditions there are growing worse each week.

Philip Wick of Youngstown, Ohio, a director and vice-president of the Trumbull Steel Co., Warren, Ohio, who has returned from Europe, declares that according to reports abroad Russia is making definite progress, both in a commercial and social way.

Church A. Williams, formerly general superintendent Verona Steel Castings Co., Verona, Pa., has accepted a position as superintendent of open-hearth furnaces, Park works, Crescent Steel Co. of America, Pittsburgh. Before joining the Verona Steel Castings Co. he was with the Keystone Steel & Wire Co., Peoria, Ill.

Traveling cranes, conveying and other machinery will be installed on the new coke handling plant to be constructed by the Carnegie Steel Co., Carnegie Building, Pittsburgh, at its Mingo Junction, Ohio, plant, to cost $500,000. The company plans to supply the coke requirements of the Mingo furnaces by river shipments from Clairton, Pa., with the completion of an addition to the Clairton by-product coke plant.

The British Empire Steel Corporation plans to put into operation its battery of coke ovens erected in 1921 at its Sydney, N. S., plant. These ovens have been idle since their erection, the company securing a sufficient supply of coke from the other two batteries constructed early in the war years.

OBITUARY

General Charles Lane Fitzhugh

GENERAL CHARLES LANE FITZHUGH, former president of the Shoenberger Steel Co., Pittsburgh, who died at his summer home in Coburg, Ontario, Sept. 16, as fully recorded in THE IRON AGE last week, was born in Oswego, N. Y., Aug. 22, 1838. He was of distinguished ancestry, being a descendent on his paternal side from William Fitzhugh of Bedfordshire, England, who settled in Stafford County, Va., in 1670, and on his maternal side from Charles Carroll of Litereuna, Ireland, who settled in Maryland in 1671, and among whose descendents were Charles Carroll of Carrollton, one of the signers of the Declaration of Independence. General Fitzhugh was educated in the Oswego schools and at the Canandaigua Academy, Canandaigua, N. Y. After a year at Yale University, he entered West Point in June, 1859. At the outbreak of the Civil War, he was commissioned first lieutenant in the Fourth United States Artillery and served with distinction throughout the conflict, being brevetted captain in April, 1862, for gallant and meritorious service at the battle of Shiloh, major, Aug. 28, 1864, and colonel and brigadier-general March 13, 1865. From May, 1865, he was on the staff of General Sheridan on duty in Louisiana and Texas until November, 1868, when as captain of the Seventh United States Cavalry, he resigned his commission. From 1868 to 1869 he was a member of the firm of Shoenberger & Co. and was president of the company, which had been reorganized as the Shoenberger Steel Co., from 1896 to 1899, when it was taken over by the American Steel & Wire Co. General Fitzhugh then retired from active business. Since 1902 he had made his home in Washington. Mrs. Fitzhugh, who was Emma Shoenberger, a granddaughter of Peter Shoenberger, founder of the business, and two sons, Henry and Carroll Hamilton Fitzhugh, survive.

William L. Hirsch, formerly secretary of the Shoenberger Steel Co. and later sales manager of the American Steel & Wire Co., Pittsburgh district, writes THE IRON AGE: "With much sorrow I learned of the death of Gen. Charles L. Fitzhugh some days ago, and I cannot add anything in tribute to his brilliant and splendid record except to testify that it was my great privilege to spend 20 years in close business association with him, when with the Shoenberger Steel Co. The firm was composed of Gen. C. L. Fitzhugh, John Z. Speer and G. A. Steiner. General Fitzhugh was for many years president of the company. During all the years I was with the company it was a pleasure to be in daily contact with him. Sweet memories of this splendid and handsome man recall that he was kind, polite, gentle, helpful and courteous to all his associates and employees. The world is better that he lived and the memory of him everlasting."

GORDON BATTELLE, an active figure in the iron and steel business in the Middle West, died suddenly at his home in Columbus, Ohio, on Sept. 21, aged 40 years. He was a director of the American Rolling Mill Co. and the Inland Steel Co. Mr. Battelle was also president and treasurer of the International Steel Products Co. and the International Derrick & Equipment Co., Columbus, as well as a director of the Republic Fuming & Refining Co. and the Ohio Mining Co.

JOHN J. DALY, a dealer in iron and steel scrap, died at his home, 71 Remsen Street, Astoria, Long Island, Sept. 22. Mr. Daly, who was 51 years of age, had been in the scrap business for about 35 years and had maintained a large yard in Long Island City for the past 31 years. For several years past his son, John J. Daly, Jr., has been associated with him in the business. Mr. Daly was at one time excise commissioner of Long Island City.

Pig Iron Prices Reduced $2 in Toronto and Montreal Markets

TORONTO, ONT., Sept. 24.—Canadian blast furnace operators have again reduced the price of pig iron. This reduction, which became effective Sept. 22, amounts to $2 per ton in both Toronto and Montreal markets. While no definite reason has been given for this lowering of price it might safely be stated that the chief cause is the present state of the Buffalo market, together with the small demand that has existed for pig iron in the Canadian market during the past three months.

Importation of pig iron into Canada from the United States and Great Britain has been very limited for some time past, and practically the entire iron consumed here is produced by Canadian furnaces. Some special grades have, however, recently reached the Canadian market from United States furnaces. British iron has not been coming in for some time, and while dealers in the Montreal district are quoting Summerlee at $40 and Carron at $39 per ton in lots of 5 tons and up in the Montreal district, the demand for this commodity as well as the supply on hand is small. The prevailing price on Canadian iron is as follows: No. 1 (2.25 to 2.75 silicon), $31; malleable, $31; No. 2 (1.75 to 2.25 silicon), $30, Toronto. Montreal prices are No. 1 and malleable, $33.50; No. 2, $32.50.

Ohio Foundries Not So Active

The Ohio State Foundrymen's Association reports that operations for August were on the basis of 79.56 per cent of normal or capacity, which is a tapering off as compared with July, 1923. July operations were on the basis of 85.32 per cent of normal. The August decline was expected.

The normal melt figure or the capacity of all of the foundries reporting is equal to 22,683 tons. Against this possible production there was produced 18,048 tons, which is equal to 79.56 per cent.

The stocks of scrap and pig iron received were 14,899 tons. This, compared with the normal melt or 100 per cent figure, equals a percentage of 65 compared with 37 per cent in July.

Total stocks on hand show an increase over July. The total stocks on hand are 23,033 tons, which compared with the normal melt figure of 22,683 equals 101 per cent. July stood at 96 per cent and August, 1922, at 90 per cent.

Non-ferrous operations have increased over July, which figure stood at 77.22 per cent of normal or capacity. August shows a figure of 80.7 per cent.

Protests Against Freight Rates

WASHINGTON, Sept. 25.—Protests against and requests for the suspension of tariffs, scheduled to become effective Oct. 7, advancing freight rates on iron and steel products from the Pittsburgh district to New Castle, Pa., and Cleveland, Akron, Canton, Massillon and Youngstown, have been filed with the Interstate Commerce Commission by the Jones & Laughlin Steel Corporation, the American Bridge Co., the American Sheet & Tin Plate Co., the American Steel & Wire Co., the Carnegie Steel Co., the Lorain Steel Co., and the National Tube Co. The proposed increases are based on the decision of the commission in the American Shipbuilding Co. case which involved the so-called short-haul rates on iron and steel products. The protestants claim the rate increases would range from 31.2 to 60 per cent.

Total exports of iron and steel from Germany for the first six months of this year, incomplete because of the Ruhr occupation, were 976,392 metric tons as compared with 1,234,332 tons for the first six months of 1922. Imports to July 1 were 927,056 tons as against 910,798 tons in the first half of 1922.

To Buy Foundry Pig Iron by Analysis

(*Concluded from page* 837)

sis. The congress expects the furnacemen and foundrymen jointly to reach some agreement on the subject in the very near future.

The passage of the resolution was strongly applauded. M. Ramas also called attention to the fact that the Department of Commerce at Washington was interested in this action and was assisting Messrs. Wood and Moldenke in the negotiations. A French furnaceman present approved of the American specifications and held that it was the best method of giving the foundryman what he wants. The subject will be worked up further before the close of the congress.

Next came a paper by Prof. Pisek, president of the Association of Foundrymen of Tchéco-Slovakia, on "Use of Alloys for Machine Castings." This was a very elaborate paper of great scientific interest. It was not discussed. Next a representative of Lieut. Col. Jaime Coll of Spain read his two papers on the fatigue of cast iron and cupola reactions.

The paper by M. Masson had not yet come from the press, but with the paper by M. Varlet, both men of Belgium, a summary of the war loss situation was given so far as foundries were concerned. The discussion brought out a lot of hard facts in connection with the capture of trade by the Germans, aside from the actual money loss.

American Papers

In the meantime, at the English-speaking session, there were interesting proceedings. It was learned that many foundrymen were present from Tchéco-Slovakia and even from India, while the previous evening there had been a dinner for the Spanish foundrymen, at which 146 participated.

President Clamer of the A. F. A. opened the meeting for the reading of the papers by Americans. The first subject, which proved the one most discussed, was on "Test Bars," on the basis of the paper of Doctor Moldenke. He outlined his paper again, as on the previous day for the French meeting, and explained in addition that the American party had in the meantime come in contact with many problems that confront both the British foundrymen as well as those of France. Hence the Americans were certainly inclined to keep their minds open on the subject of international action in this direction. This contact had shown that the whole subject was shaping itself into testing for the quality of the metal used and testing for the quality of the castings. Doctor Moldenke read again the resolution passed on the day previous regarding this matter, and the long discussion which followed only emphasized the correctness of this viewpoint, even if it was held difficult to carry through practically.

The discussion itself was participated in by Mr. Shaw and Mr. Ronceray in a brisk clash on the value of the Frémont test method of boring out small test pieces from the castings themselves. Mr. Wood explained the American way of using any shop test bar, but getting comparison with the standard arbitration bar for adjustment in case of dispute. He held that unquestionably the several methods brought out would find special application which was quite satisfactory, even if not specified for general or international use. Mr. Lane also gave instances of testing castings, and Doctor Moldenke finally reviewed and closed the discussion.

H. M. Lane followed with his paper on the handling and preparation of foundry sands, showing how oftentimes sand has to be handled nine times in the course of making a casting; that it took about 1900 lb. of sand to make a bathtub, and that the sand problem is usually more costly than the iron involved. He explained the casting losses when tempered sand is put on a long open belt and urged transportation of sand in closed containers or conveyors and off the foundry floor.

Cast Iron and Mass Effect

Mr. Clamer now turned the chair over to Mr. Stubbs, president of the Institution of British Foundrymen, who called for the English papers, beginning with that of Mr. Smalley, on "Cast Iron and Mass Effect." In the discussion that followed, inquiry was made whether quickly and slowly setting metal had been considered, to which Mr. Smalley replied that particular care had been taken with their cupola melting practice to avoid all chances of oxidation. Mr. Holmes called attention to the possibility of a very heavy mold yielding, thus increasing the volume unduly at the time when no more molten metal could feed in. Mr. Smalley thought that the metal would set fast enough in such a mold to prevent the action indicated. Mr. Lambert called attention to the difficulty in getting practical papers on mass effect in cast iron.

Mr. Fletcher emphasized the importance of the latent heat phenomena observed, and that his experience was that manganese was an important factor in the matter. The study of mass effect would have an important bearing on the design of castings; finally, the speed of pouring was a vital point to be considered. An interesting point brought out by Mr. Smalley was his making cores of steel shot, to get a chilling effect inside a casting. The shot were held together by a good core binder.

At this point Mr. Stubbs introduced Stanley G. Flagg, Jr., Philadelphia, and assured him of the sympathy of the congress with his misfortune in accidentally breaking his shoulder by slipping on the channel steamer deck. Mr. Flagg responded happily and wished the congress every success.

Magnesium in the Foundry

Mr. Mabrey now presented his paper on the use of magnesium in foundry operations. In the discussion, Mr. Lambert pointed out the necessity of using a pure metal for castings, as much magnesium was on the market with less than 95 per cent metallic Gg. With poor metal there would be subsequent efflorescent effects which were highly troublesome. He had used such metal in his cabinet for steel specimens, which were kept bright by the absorption of the injurious properties of the air within by the bad magnesium placed there. A Swedish foundryman present volunteered the information that in pouring magnesium into molds the latter were made of sand mixed with sulphur, and that the gases formed thus would prevent the burning of the magnesium.

Mr. Adamson gave his paper on the graphitization of cast iron, the summary of the points being that he considered it necessary to grade both by fracture and analysis in the case of English irons. Mr. Holmes followed with his paper on testing molding sands. This paper will appear shortly in the technical press. The author's methods differ somewhat from those worked out by the American committee, as he shakes the sample with water for an hour and differentiates the grain sizes that way. The Eugene Smith method is held to be subject to errors. Mr. Holmes pleads for uniformity in standards, not mixing pounds and feet with millimeters and cubic centimeters. The presentation of the paper had to be cut short on account of the lateness of the hour, the Parisian dinner hour being sacred. After a paper by Lieutenant Coll on cupola reactions the English-speaking section adjourned.

In the meantime the ladies were conducted to Montmartre, the Isle of Paris, also Notre Dame and Palais de Justice; then after lunch to the Luxemburg and the Pantheon, etc. The foundrymen took a trip to the surrounding foundries, visiting three of them during the afternoon.

R. M.

The desirability of storing coal has been seized on, owing partly to the timeliness of the topic, by the McMyler-Interstate Co., Cleveland, as an opportunity to issue a sales letter of an unusual kind. It amounts to a printed type-written missive of several pages illustrated with half-tone engravings of the forms of cranes which the company builds adaptable to handling coal to and from storage. Similar letters have been used in the past but it is not always that they have been tied to a topic of national economic interest.

A new line of glass oilers has been placed on the market by the Penberthy Injector Co., Detroit.

REFRACTORIES ARE IRREGULAR

Business in the West Better Than in the East—Some Prices Lower

PITTSBURGH, Sept. 24.—Much irregularity is observed in the refractories market, both as regards prices and business. In the West, manufacturers appear to be still enjoying a reasonably good business, but here and to the East, matters are pretty quiet, as regards purchases and specifications against old orders. In all territories, some makers are better off than others in the matter of bookings and this condition promotes deviations from what are supposed to be the regular quotations on the part of those who have the lightest order books. The market on clay fire brick now is quotable in practically all districts at $45 for large lots of high duty brick, this representing a drop of $1 per 1000 and even that price is not religiously observed when an attractive inquiry develops. Small makers of silica brick in the Eastern district continue to take business at $42 and that price is said to have been made by some of the larger producers on contracts. As a sales basis, $45 is no longer a representative quotation. Ground clay and silica are lower. There is no change in magnesite and chrome brick. Prices are given on page 863.

Monthly report of the Refractories Manufacturers' Association, F. W. Donahoe, Oliver Building, Pittsburgh, secretary, notes a slight gain in clay fire brick shipments in August as compared with July, and a gain in net new business for the month, but production also gained and stocks at the end of the month showed an increase of 3 per cent as compared with that at the beginning of the month and unfilled orders sustained a decline for the month of about 8,500,000 brick. Shipments and production of silica brick in August were almost equal, but new business declined and unfilled business did also.

Figures in 9-in. equivalents, figures in parenthesis, being the percentages to economical monthly producing capacity, follow:

	August	July
Clay Fire Brick		
Capacity reporting	74,341,977	74,591,977
Stock, first of month	157,432,125 (211)	155,573,382 (208)
Production	58,839,866 (79)	56,976,868 (76)
Shipments	56,219,590 (75)	54,607,581 (73)
Stock, end of month	160,052,401 (214)	157,942,669 (212)
New orders	48,505,006 (65)	45,773,431 (61)
Cancellations	645,660 (1)	605,177 (1)
Net new business	47,859,346 (64)	45,168,254 (107)
Unfilled orders	71,400,345 (96)	79,926,439 (107)
Silica Brick		
Capacity reporting	22,565,500	22,565,500
Stock, first of month	34,243,812 (152)	34,310,226 (152)
Production	10,245,769 (45)	11,980,788 (53)
Shipments	10,132,789 (45)	12,047,202 (53)
Stock, end of month	34,356,792 (152)	34,243,812 (152)
New orders	6,695,726 (30)	8,351,087 (37)
Cancellations	135,512 (1)	556,712 (2)
Net new business	6,560,214 (29)	7,794,357 (35)
Unfilled orders	27,202,475 (121)	30,775,050 (136)

There seems to have been some misunderstanding or misrepresentation of some of the items in these tables. It has been figured, for instance, that the difference in tonnage, or in percentage of monthly capacity, between that shown as stock on hand at end of month and unfilled orders at end of month indicates free stock. It is a misconception that any great part of this tonnage is available for shipment on new orders, unless those new orders call for just such shapes as happen to be in stock, which would be unusual. It is not uncommon for large producers to carry one or more blast furnace linings in stock. Much of the stock also is odds and ends—the excess production of times when a full run on certain shapes is more economical practice than limiting production to the exact number required by the order in hand.

Time Studies of Grinding and Polishing

An efficiency demonstration conducted in the presence of 35 representatives of 21 companies likely to be interested in the machine was made on Aug. 29 of a redesigned type of the No. 27 automatic grinding and polishing machine built by the Excelsior Tool & Machine Co., East St. Louis, Ill. The test was made at the Excelsior plant to establish a fair cost of polishing stove tops and manifold gas pipes.

No special preparations were made for this occasion. A stock polishing machine and regular stove tops and common rough gas pipe were used. The stove top cast iron was size 25 x 37 in. to 40 in. long, or 7 sq. ft., consisting of six 8-in. covers and loose sectional anchor plates and shelving, not sand blasted or pickled. The threaded rough gas pipe was ¾ in. in 2-ft. lengths. The stove top was ground and polished with four different wheels to a high commercial finish in 19 min. 38 sec., which is equal to 24 stove tops or 168 sq. ft. in 8 hr. The gas pipe or manifolds were ground and polished with 4 different wheels ready for nickeling at the rate of 10 pipe in 17 min. 28 sec., which is equal to 34 2-ft. lengths of pipe in 1 hr. or 544 lin. ft. in 8 hr. Buffing nickel plated pipe was done at the rate of 400 lin. ft. per hr.

The changing of wheels and tops was included in the time, but not time for glueing up, balancing or truing up the wheels or the changing of machine.

Among those present were Lawrence D. Bridge, superintendent Bridge & Beach Mfg. Co.; E. R. Funck, purchasing agent and J. Krauss, superintendent Bucks Stove & Range Co.; A. G. Haferkorn, vice-president C. Heinz Stove Co.; F. E. Terrio, treasurer and manager, La Salco, Inc.; George Lamkemeyer, foreman Majestic Mfg. Co.; George P. Hamman, superintendent Quick Meal Stove & Range Co.; L. H. Winter, purchasing agent and treasurer Wrought Iron Range Co., all of St. Louis; E. S. Simpson, production engineer American Stove & Range Foundry Co., East St. Louis, Ill.; Louis M. Hofmeister, Auto Stove Works, New Athens, Ill.; W. C. Audel, Belleville Stove & Range Co., Belleville, Ill.; George E. Baker, president Baker Stove Co., Belleville, Ill.; Charles J. Corty, Belleville, Ill.; N. Willard, Eureka Stove Mfg. Co., O'Fallon, Ill.; Adam Karr, Karr Range Co., Belleville, Ill.; G. Marsh, manager plating and polishing department Orbon Stove Range Co., Belleville, Ill.; A. E. Krebs, manager Perfect Stove Co., Belleville, Ill.; H. Lange, secretary and treasurer Quincy Stove Mfg. Co., Quincy, Ill.; Joseph P. Roesch, president Roesch Enamel Range Co., Belleville, Ill.; Charles L. Gohmann, president Gohmann Brothers & Kahler Co., New Albany, Ind., and Charles Emory, foreman Great Western Stove Works, Leavenworth, Kan.

Steel Furniture Stock Business

WASHINGTON, Sept. 22.—The Department of Commerce announces that August shipments of steel-furniture stock goods, based on reports received from 22 manufacturers, amounted to $1,345,147 in August, as against $1,247,605 in July, and $943,087 in August, 1922. The following table gives comparative figures for the first eight months of 1923 and 1922:

	1923	1922
January	$1,362,470	$983,834
February	1,307,173	967,125
March	1,709,206	1,087,228
April	1,520,286	1,058,382
May	1,506,072	1,056,735
June	1,401,950	1,015,463
July	1,247,605	945,768
August	1,345,147	943,087

British Steel Output by Grades in 1922

The production of steel ingots and castings of Great Britain for 1922, according to revised returns was as follows in gross tons:

Ingots	
Acid open-hearth	1,680,000
Basic open-hearth	3,624,300
Acid Bessemer	272,500
Basic Bessemer	196,000
Electric	21,300
Castings	
Electric	18,100
Open-hearth, Bessemer, etc	68,000
Total	5,880,600

A feature is the heavy output of basic open-hearth steel. The total electric steel production was 39,400 tons which compares with 27,100 tons in 1921 and 89,100 tons in 1920.

Machinery Markets and News of the Works

JAPAN IS INQUIRING

Machinery for Rebuilding Arsenals May Be Bought in United States

Some Railroad Business Still Being Placed, But Orders Generally Are Very Light

A development of interest is the receipt of inquiries from Japan for machine tools to replace those destroyed in arsenals there in the recent earthquake. So far these inquiries, though cabled to this country have been in rather indefinite form. Automatic screw machinery is one of the items at present in demand. Punching and shearing machinery, it is indicated, will also be an early requirement.

Railroad business is not conspicuous in volume, but in comparison with the small number of orders coming from industrial plants it is still the outstanding feature of the domestic market, both as regards present and future buying. The Pennsylvania Railroad has begun placing orders for its eastern shops. A list of tools for its shops in the central region, issued some time ago, has not been acted upon, but it is expected that orders may go out this week.

At Chicago there is a revival of prospects of railroad buying. The Chicago, Burlington & Quincy is about to place orders within a week or 10 days, according to trade reports, on a list issued some time ago. The Illinois Central has asked for prices on four machines. The Chicago & North Western and the Chicago, Rock Island & Pacific are getting figures for 1924 budget purposes. The Louisville & Nashville, Chesapeake & Ohio and Southern roads are reported to be considering the purchase of equipment for various shops.

There is some miscellanous business, but it is very light in volume.

New York

NEW YORK, Sept. 25.

SEPTEMBER has brought no increase in machine-tool business in the Eastern district, and the situation is about as dull as it has been in the past two months. Inquiries are few and orders are just as scarce. There is a little buying of single tools, but the aggregate of such orders is nowhere near what is considered a "normal" business. The Southern Pacific Railroad has added two axle lathes to the orders placed a couple of weeks ago, but this is the only railroad buying of importance in the past week.

The Multi Metal Co., 251 West Nineteenth Street, New York, manufacturer of wire cloth, etc., has engaged H. Fanenbaum, 530 Main Street, New Rochelle, N. Y., architect, to prepare plans for its proposed one-story factory, 75 x 100 ft., on 139th Street, near the Southern Boulevard.

The State Department, Wellington, New Zealand, is arranging a fund of $4,500,000 for the installation and operation of a hydroelectric generating plant at Lake Waikaremoana, North Island, to be expended during the next 12 months. The initial capacity will approximate 24,000 hp., which will be increased to 50,000 hp., with transmission system to Auckland and vicinity.

The Stucky International Mining & Milling Co., Lampazos, N. L., Mexico, is planning to purchase mining, concentrating and electric power equipment for the production of lead, zinc and other metals.

The Universal Can Co., an interest of the Nestlé Food Co., 130 William Street, New York, J. F. Montgomery, in charge, is planning for the installation of equipment in a factory at Hiresdale.

Officials of the American Smelting & Refining Co., 120 Broadway, New York, have organized the Towne Mines, Inc., with capital of $4,000,000 and 40,000 shares of common stock, no par value. The new company will acquire the property of the Compania Metalurgica Mexicana in Mexico, and plans extensions and the installation of additional machinery. F. H. Brownell is president, and William Loeb and D. C. Brown, vice-presidents.

The Great Eastern Sugar Co., New York, Willard N. Bayliss and George Copeland, 141 Broadway, New York, representatives, recently organized under State laws, is perfecting plans for a beet sugar mill on Long Island, to include power house and machine shop, estimated to cost $1,500,000 with machinery. Kurt Grunwald heads the company.

The Long Island Railroad Co., Pennsylvania Terminal, New York, is planning the purchase of additional equipment to cost about $2,860,000, including electric power apparatus.

The New York Radio Co., Brooklyn, has leased the building at 81 Flatbush Avenue, for a new works, and will install equipment as soon as alterations and improvements are made. Saul Modell is one of the heads of the company.

Bids are being asked on a general contract for a one-story foundry and machine shop at the plant of the Columbia Malleable Iron Works, Atlantic and Euclid Avenues, Brooklyn, to replace the structure recently destroyed by fire. Holmes & Winslow, 134 East Forty-fourth Street, New York, are architects; Ward & Bender, 120 Broadway, New York, are engineers.

The Reo Motor Car Co. of New York, Inc., 1709 Broadway, New York, has acquired property, 100 x 170 ft., at 625 West Fifty-fifth Street, as a site for a six-story factory branch, with service and repair departments. Parker & Shaffer, 469 Fifth Avenue, are architects and engineers.

The Anaconda Copper Mining Co., 25 Broadway, New York, is planning the erection of an addition to its wire plant at Butte, Mont., 50 x 125 ft., estimated to cost $75,000.

Thomas A. Digan, Inc., 656 Third Avenue, Brooklyn, has engaged David M. Ach, 1 Madison Avenue, New York, architect, to prepare plans for a two-story and basement cold storage plant on Thirty-ninth Street, Brooklyn, to cost $65,000, with machinery.

The Department of Public Works, J. A. Lynch, Borough Hall, New Brighton, S. I., has awarded a general contract to the Anderson Construction Co., Port Richmond, S. I., for a new one-story machine and repair shop, 50 x 95 ft., on the Clove Road, West New Brighton, for municipal motor trucks and cars, estimated to cost $42,000. W. F. McCulloch, 350 Madison Avenue, New York, is architect.

The American Hoist & Derrick Co., 50 Church Street, New York, with plant at St. Paul, Minn., has secured a portion of the works of the Terry Mfg. Co., 15 Exchange Place, Jersey City, N. J., manufacturer of derricks, cranes, etc., at Kearny, N. J., for $156,000 and will use the property for a new Eastern branch. The Terry company has been in receivership since September, 1922, and the receivers have divided the plant into two parcels; the remaining section will be sold for $118,000, which amount, it is stated, has been offered by the Holland Co., for derrick and hoist manufacture.

The Bessemer-American Motors Corporation, Plainfield, N. J., will expand and concentrate production at its local plant in October, for the manufacture of motor trucks and American automobiles and parts. The Philadelphia works of the company were sold recently and operations previously conducted there will be transferred to Plainfield.

The Royal Motor Coach Co., Inc., 285 Bloomfield Avenue, Caldwell, N. J., William B. Brandley, representative, has acquired the plant and adjoining site of the Lincoln Body Co., St. Georges Avenue, Rahway, N. J., for its new works to manufacture motor buses. It is purposed to equip the plant to include all features of production. The company was

organized recently with a capital of $500,000. Ralph De Camp, Livingston, N. J., is head; Mark A. Smith is vice-president and general manager.

The Common Council, Park Ridge, N. J., is planning the installation of electrically-operated pumping machinery in connection with a new waterworks plant estimated to cost $200,000. H. J. Harder, 129 Market Street, Paterson, N. J., is engineer.

The Alexander Hamilton Garage, Inc., 777 Madison Avenue, Paterson, N. J., will take bids in October for a four-story automobile service and repair building, 100 x 175 ft., on Clark Street, to cost approximately $100,000. F. W. Wentworth, 140 Market Street, is architect. J. J. Fitzgerald is head.

The Intercoastal Lumber Terminals, Inc., George Quayle, Grand Central Terminal, New York, head, has leased for a term of years about 40 acres fronting on Newark Bay, Port Newark, Newark, N. J., for the establishment of a lumber terminal and distributing plant. Buildings will be erected to cost close to $2,000,000 with machinery, the latter to include electrically-operated portable cranes, overhead traveling cranes, locomotive crane, yard and dock hoisting and operating machinery, etc.

William F. Smith, Newark, is closing negotiations with Stuart A. Young and George H. Weber, equity receivers for the Sloan & Chase Mfg. Co., manufacturer of machinery and tools, for the purchase of the plant at 351 Sixth Avenue. The new owner proposes to improve the works for a kindred line of production.

The General Electric Co., Harrison, N. J., has disposed of property at Seventeenth Avenue, Boyd and Lillie Streets, Newark, to Joseph Segal, Newark, who will divide it into a number of factory units for the manufacture of mechanical products.

The Power Machinery Exchange, 1 Montgomery Street, Jersey City, N. J., is in the market for 3½ to 10-ton cranes, either hand or electrically driven.

Baltimore

BALTIMORE, Sept. 24.

THE Paper Products Co., 2405-11 West Franklin Street, Baltimore, whose plant was destroyed by fire recently with damage estimated at $350,000, including machinery, will be rebuilt at once. Joseph M. Smith is manager.

The Hatfield Resilient Wheel Co., Munsey Building, Baltimore, is having plans prepared for a factory to manufacture a patent automobile wheel, the invention of Schuyler C. Hatfield, president.

Plans for a power house to be constructed at John Hopkins Hospital, Baltimore, at a total cost of $1,000,000, have been prepared by Jcseph Evans Sperry, architect, Calvert Building.

The Board of Fire Commissioners, Baltimore, are planning the erection of a repair plant and the construction of new equipment if there are ample facilities. It will be built on the waterfront, where the plant will be handy also for the repair of the harbor fire boats. Charles A. Jording is president of the board.

The Purchasing Agent, Post Office Department, Washington, D. C., will take bids until Oct. 1 for 300 drop forged wrenches, and until Oct. 3 for 8000 ft. of rubber-covered cable.

The Electric Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, has received details regarding the recent partial destruction by fire of a hydroelectric generating plant in the vicinity of Madrid, Spain, with loss estimated at $130,000, and will furnish company name and information to American manufacturers desiring to furnish machinery for rebuilding.

Fred C. Dreyer, 23½ North Mechanic Street, Cumberland, Md., manufacturer's agent, is making inquiries for an engine lathe, complete with tools, chucks and countershaft, 18 in. swing, 9 ft. 6 in. between centers, used, in good condition.

A. J. Homer, Fort Valley, Ga., is in the market for used equipment for installation in a machine shop, including lathe, drill press, emery stand and other tools.

The Southern Brake Shoe Works, Inc., Portsmouth, Va., now carrying out production at the local plant of the Southern Brass Works, is having plans prepared for a new plant to cost $50,000 including equipment.

The Gennett Lumber Co., Asheville, N. C., plans the construction of a power house in connection with a new band-saw mill on a 6000-acre tract in Madison County, recently purchased. Andrew Gennett is head.

The Common Council, Andrews, N. C., is having plans completed for extensions in the municipal electric light and power plant and system, for which bonds for $350,000 have been voted. The Ludlow Engineers, Inc., Winston-Salem, N. C., is engineer.

The Laurel Run Lumber Co, Frostburg, Md., has tentative plans for a power house in connection with a new plant in the Laurel Run section. The company was formed recently with a capital of $250,000. Joseph T. Blake is head.

The Atlantic Sign Corporation, Fifth and Maxwell Avenues, Baltimore, has inquiries out for a steel shears, 52 in. wide, capable of cutting 14 gage metal and heavier stock.

The Atlantic Coast Line Railway Co., Wilmington, N. C., will commence the installation of a new electrically-operated air plant for train-testing service at its yards at Florence, S. C., estimated to cost $25,000. Other extensions will be made, including the installation of new coaling equipment.

The Smith Cutlery Co., Danville, Va., recently organized with a capital of $100,000, is perfecting plans for the establishment of a plant to manufacture cutlery. The company is in the market for equipment, including machinery for the production of shears, snips, pruning knives, etc. G. W. Gammon is president, and H. A. W. Smith, secretary.

Bids will be received by the Board of Water Commissioners, Macon, Ga., until Oct. 16, for the installation of a new pumping plant, with machinery, for a capacity of 10,000,000 gal. per day.

Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Oct. 12 for mechanical equipment, including manganese steel pinions, electric motors, fans, grindstones, wire and cable, crucibles, etc., as set forth in circular 1558.

The Clinchfield Motor Co., Coeburn, Va., recently organized, is planning for the construction of a new two-story service building with machine shop, at West Coeburn, estimated to cost $50,000. Fayette Stallard heads the company.

The Board of Education, Columbia, S. C., has authorized plans for a two-story industrial school, with complete manual training department, on Lady Street, to be used for negro pupils. Bids will be asked at an early date. J. H. Sams, Columbia, is architect.

G. H. Rowan, Egypt, Ga., has inquiries out for a boiler, steam engine and auxiliary equipment for a power house.

The Thornhill Wagon Co., Lynchburg, Va., is planning for the installation of additional equipment, and has inquiries out for a hub lathe, block-cut saw, borer and reamer, and other apparatus.

Manual training equipment will be installed in the new junior high school to be erected at Durham, N. C., estimated to cost $100,000. The Milburn-Heister Co., Durham, is architect.

George H. Martin & Co., 940 Linden Avenue, Baltimore, are having plans drawn for the erection of a one and two-story automobile service and repair building, with machine

The Crane Market

The crane market is extremely quiet with a fair volume of pending business but few new inquiries for either electric overhead, hand power or locomotive cranes. Although the Western Electric Co., is reported to be purchasing some equipment for the new plant being erected in New Jersey, no inquiry for cranes has as yet appeared. The inquiry for six small capacity electric cranes with an alternate price on hand power cranes issued a few weeks ago by the Long Island Railroad, for estimating purposes only, is still inactive. Clement A. Hardy, engineer, Chicago, is asking for prices on a 15-ton electric traveling crane. The Illinois Steel Co., Chicago, is inquiring for a 3½-cu. yd. bucket crane for coal handling. The Griffin Wheel Co., Chicago, is inquiring for two 1-ton pit cranes for its Detroit plant.

Among recent purchases are:

Monahan Stone Co., Newark, N. J., a 10-ton, 44-ft. span electric traveling crane from the Shaw Electric Crane Co.

Southern Pacific Co., 165 Broadway, New York, a 10-ton, 33-ft. span electric traveling crane from the Shaw Electric Crane Co.

Whitehead Construction Co., Flint, Mich., a 25-ton, used Browning locomotive crane from Philip T. King, 30 Church Street, N. Y.

Lorain Steel Co., Johnstown, Pa., a 3-ton, 3-motor overhead traveling crane from the Northern Engineering Works.

Packard Electric Co., Warren, Ohio, a 25-ton, 28-ft. 3-in. span, 4-motor overhead crane with 5-ton auxiliary from the Cleveland Crane & Engineering Co.

Carnegie Steel Co., Pittsburgh, 14 electric jib cranes for the Duquesne works open-hearth department, from the Whiting Corporation.

shop, at Elgin Avenue and Payson Street, to cost about $50,000. Stanislaus Russell, 11 East Lexington Street, is architect.

The Common Council, Salisbury, N. C., plans the installation of electrically-operated pumping machinery in connection with extensions and improvements in the waterworks plant, estimated to cost $35,000.

Frank Talbott, superintendent water department, Danville, Va., will receive bids until Oct. 11 for electrically-operated high and low lift centrifugal pumping machinery for the municipal waterworks. Hazen & Whipple, 25 West Forty-third Street, New York, are engineers.

New England

BOSTON, Sept. 24.

SUPERSTRUCTURE work is under way on a new foundry, 135 x 240 ft., for the Hunt-Spiller Mfg. Co., 383 Dorchester Avenue, Boston, estimated to cost $150,000 with equipment, for which a general contract was awarded recently to the C. A. Dodge Co., Erie Street, Cambridge, Mass. The company specializes in the manufacture of gun and other steel castings.

Manual training equipment will be installed in the new three-story junior high school to be erected at North Park Street and President Avenue, Fall River, Mass., estimated to cost $700,000, for which bids will soon be asked on a general contract. Nathaniel C. Chase, 47 Borden Building, is architect.

The Hope Machine Co., 13 Hope Avenue, Worcester, Mass., has awarded a general contract to the E. J. Cross Co., 82 Foster Street, for a two-story addition, 75 x 100 ft.

Fire, Sept. 15, destroyed a number of buildings at the Maine State Prison, Thomaston, Me., including a new forge and blacksmithing shop, recently completed at a cost of $100,000, and several other shops, with loss placed at $500,000 with equipment. It is planned to rebuild.

The Board of Works, Springfield, Mass., has tentative plans for a one-story municipal machine and repair shop for the fire department, estimated to cost $23,000.

Contract will soon be let for two additions at the plant of the Textile Finishing Machinery Co., 171 Westminster Street, Providence R. I., comprising a two-story structure, 60 x 100 ft., to be equipped as a roll shop, and a building, 75 x 120 ft., one-story, to be used as a press works. The cost is estimated at $185,000, including equipment. Lockwood, Green & Co., 24 Federal Street, Boston, are engineers.

The New England Power Co., 50 Congress Street, Boston, will dispose of a new bond issue of $2,800,000, the proceeds to be used in connection with the installation of a hydro-electric generating plant at Davis Bridge on the Deerfield River, with capacity of 60,000 hp.

The Connecticut Foundry Co., Rocky Hill, Conn., has acquired a controlling interest in the Valley Foundry Co., East Hampton, Conn., and has reorganized the latter company. Plans are under consideration for expansion. A. O. Knudson is president.

The Taylor-Hall Welding Corporation, Worcester, Mass., recently organized, has acquired the local branch plant and business of the Thomson Electric Welding Co., with main works at Lynn, Mass. The new owner plans extensions and considerable increase in production. Preston M. Hall is president, and Louis S. Taylor, treasurer.

Philadelphia

PHILADELPHIA, Sept. 24.

CONTRACT has been let by the Remington & Sherman Co., 636 Richmond Street, Philadelphia, manufacturer of safes, vaults, etc., to the Austin Co., for extensions in its plant to cost about $23,000.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until Oct. 2, for 1800 ft. of steel wire rope, schedule 1341, until Oct. 9, for 100 airplane wheels, schedule 1345.

The R. A. Erwin Motor Co., 9533 Rustleton Avenue, Philadelphia, R. A. Erwin, head, has plans for a one-story and basement service and repair building, 80 x 190 ft., with machine shop, estimated to cost $55,000. Charles Fries, 8237 D Street, is architect.

Electric power equipment, transmission, conveying and other machinery will be installed in the five-story addition to be erected at the confectionery manufacturing plant of the J. Frank Shellenberger Co., Front and Race Streets, Philadelphia, to cost $200,000 with equipment. Clarence E. Wunder, 1415 Locust Street, is architect.

The Philadelphia & Reading Railroad Co., Reading Terminal, Philadelphia, has authorized a fund of $250,000, for improvements at the terminal yards at Rutherford, Pa., including a new coaling plant, water column equipment, engine pits and repair equipment, etc.

The Ford Motor Co., Highland Park, Mich., has authorized the construction of a power plant at its new assembling works at Sixty-third Street and Schuylkill River, Philadelphia, and plans will be drawn by Albert Kahn, 1000 Marquette Building, Detroit, architect. Bids are being asked for structural steel for the first unit of the assembling plant, estimated to cost $500,000. The same architect is in charge.

The American Ice. Co., 121 North Broad Street, Philadelphia, is taking bids for the erection of a three-story addition to its plant at Washington and Seventeenth Streets, 58 x 150 ft., estimated to cost $85,000. C. L. Weir, 41 East Forty-second Street, New York, is architect.

The MacAndrews & Forbes Co., Jefferson and Third Streets, Camden, N. J., manufacturer of wallboard, boxboard and kindred products, has awarded contract to Barclay White & Co., 1713 Sansom Street, Philadelphia, for a one-story and basement addition, 70 x 179 ft., estimated to cost $100,000, including equipment.

The Wilkes-Barre Buick Co., South Main and South Streets, Wilkes-Barre, Pa., representative for the Buick automobile, is having plans drawn for a two-story service and repair building, 75 x 120 ft., at Kingston, Pa., to cost $75,000. Knapp & Bosworth, 15 South Franklin Street, Wilkes-Barre, architects, will soon take bids.

The Miller Lock Co., 4530 Tacony Street, Philadelphia, has inquiries out for an embossing press, toggle joint, about 200 tons capacity, used, in good condition.

The Erie Railroad Co., Jersey City, N. J., is arranging to close its locomotive repair shops at Dunmore, Pa., within 90 days and proposes to abandon operations entirely at this point. Work will be concentrated at Hornell, N. Y., where construction is in progress on a number of shop buildings for heavy repair service.

The Bryden Horseshoe Co., Catasauqua, Pa., is pushing construction on new buildings at its plant and purposes to install equipment at an early date. The works have been placed on a 24-hr. operating basis.

Fire, Sept. 14, destroyed a portion of the plant of the Phoenix Portland Cement Co., Nazareth, Pa., including finishing mill with machinery, and adjoining structures, 60 x 80 ft., 80 x 80 ft., and 50 x 60 ft., respectively, with loss estimated at $500,000, including equipment. The machine shop and power house were saved. It is planned to rebuild. J. W. Walker is vice-president, and E. P. Haubert, secretary and assistant treasurer.

Manual training equipment will be installed in the new two-story and basement high school to be erected at Mount Carmel, Pa., estimated to cost $150,000, for which plans are being prepared by J. A. McGlynn, Simon Long Building, Wilkes-Barre, Pa., architect.

Work will commence on a new power house at the vocational shops of the William Penn high school, Harrisburg, Pa., to cost about $60,000. The Board of Education is in charge.

The Grantville Electric Co., Cold Spring Electric Co., and the East Hanover Electric Co. have been organized under State laws to operate power plants and systems for commercial service. The companies are headed by H. G. Stambaugh, Rehrersburg, Pa.; S. S. Seyfert, Bethlehem, Pa., and J. G. Rich, Bethel, Pa.

Fire, Sept. 13, destroyed a portion of the plant of the Quarryville Body Building Co., Quarryville, Pa., manufacturerer of automobile bodies, etc., with loss estimated at $22,000, including equipment. It is planned to rebuild. Aldus Eshelman is head.

The Orion Corporation, Scranton, Pa., care of the local Board of Trade, has arranged for a lease of the building formerly used by the Victor Typewriter Co., for the establishment of new works to manufacture phonographs and parts.

Herr & Co., 7 East King Street, Lancaster, Pa., will install a machine and repair shop in their proposed three-story and basement automobile service works, 65 x 150 ft., at Chestnut and Prince Streets, estimated to cost $100,000, with equipment. M. R. Evans, 10½ East Orange Street, is architect.

The H. J. Homan Co., 1713 Sansom Street, Philadelphia, contractor, has inquiries out for pumping equipment, boilers and oil-burning apparatus, refrigerating machinery and other equipment. C. Fleming is in charge.

Manual training equipment will be installed in the new two-story and basement high school to be erected at Mechanicsburg, Pa., estimated to cost $100,000, for which bids are being asked on a general contract. Clayton J. Lappley, Ebner Building, Harrisburg, is architect.

The Mill Creek Electric Co. and the New Vernon Electric Co., Greenville, Pa., recently organized as affiliated companies, plan the installation of power house and system for general light and power service. F. A. Conner, Greenville, is treasurer of both organizations.

F. J. Ryan & Co., Wesley Building, Philadelphia, report contracts in part as follows: Standard Steel & Bearings Co., Plainville, Conn., three double chamber car type annealing furnaces; Rickenbacker Motor Car Co., Detroit, tempering, annealing and carbonizing furnaces; Pusey & Jones Co., Wilmington, Del., equipment for oil firing of boilers; U. S. Cast Iron Pipe & Foundry Co., Birmingham, automatic control for pipe annealing furnace; Wilmington Furniture Co., Wilmington, Del., equipment for oil firing of boiler; Hupp Motor Car Corporation, Detroit, automatic pyrometer control for heat treating plant at Jackson, Mich.; Penn Seaboard Steel Co., Tacony, Pa., burner equipment for core ovens; Reading Hardware Co., Reading, Pa., 10 brass melting furnaces.

The Standard Steel & Bearings, Inc., has discontinued its Philadelphia plant, concentrating its manufacturing activities at Plainville, Conn.

Plans are being prepared for a manual training high school to be erected at Twenty-third and Federal Streets, Philadelphia, at an estimated cost of $1,000,000. Machine-tool equipment will be required, but the list will not be ready for some time. I. T. Catherine, architect for the Board of Education, is drawing the plans.

The Industrial Plants Corporation, New York, has been retained to liquidate the machinery and equipment of the Tindel-Morris Co.'s plant at Eddystone, Pa.

The Hendrick Mfg. Co., 39-75 Dundaff Street, Carbondale, Pa., is in the market for a geared press, Bliss No. 74½-B or similar, a 300-ton hydraulic press, also a pump and accumulator for these.

The Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa., is inquiring for a 4-column hydraulic press of 1000 x 1500 tons capacity 1800 lb. working pressure, approximately 4-ft. stroke and suitable for piercing billets.

The Gruen Electric Construction Co., 1721 Vine Street, Philadelphia, is in the market for a 500- to 750-hp. motor 200 volts d. c., variable speed.

Pittsburgh

PITTSBURGH, Sept. 24.

OUTSIDE of a fair number of single tools for replacement, little activity has been observed in the local machine tool trade. Purchases are solely for necessity, new projects involving a number of tools are not moving ahead with much speed and action on pending lists likewise is very slow. Activity also is lacking in cranes and other heavy equipment.

The East Ohio Mfg. Co., Warren, Ohio, for which Barton R. Shover, Oliver Building, Pittsburgh, is consulting engineer, has revised its original plans and will build on a larger scale than at first contemplated. The electrical equipment for this plant, a cold-rolled strip mill, has been purchased, but the contract for the mills is held up pending the working out of the revised plans.

Merger plans have been perfected by the Standard Plate Glass Co., Butler, Pa., and the Heidenkamp Plate Glass Corporation, Springdale, Pa., under the name of the Standard Plate Glass Corporation. Both companies specialize in the production of polished plate glass. The new company has arranged for a bond issue of $1,250,000, the proceeds to be used to carry out the merger and for proposed extensions. Frank E. Troutman is president.

The Standard Seamless Tube Co., Ambridge, Pa., is taking bids for a one-story addition to its plant, 80 x 500 ft., with extension, 23 x 80 ft., to cost $90,000.

The Midland Electric Service Co., West Union, W. Va., recently organized, has acquired property on Middle Island Creek for the erection of a new electric power plant. J. Lambert McCormick and Benjamin E. Hamrick head the company.

The West Virginia Match Co., Wheeling, W. Va., recently organized with a captial of $300,000, has acquired a local building, which will be remodeled for a new plant. Fred F. Fairs, Wheeling, is architect, in charge. Louis F. Haller and E. L. Yeager head the company.

The Monongah Glass Co., Fairmont, W. Va., has arranged for a bond issue of $1,000,000, of which about $500,000 will be used for additional units and new machinery. The company will also expand its coal properties, located about four miles from the plant, and will install electric power and other equipment. H. L. Heintzelman is president.

The West Virginia Hardware Supply Co., Huntington, W. Va., will commence the erection of a one-story building, 240 x 300 ft., estimated to cost $60,000. Meaner & Handloser, Professional Building, are architects.

Plans are being perfected for the construction of a new pumping plant at the works of the Libbey-Owens Sheet Glass Co., Kanawha City, W. Va. The DeVoe Co., Toledo, Ohio, is engineer.

Reimann & Co., 5 East Front Street, Oil City, Pa., have plans for a two-story automobile service building, with machine shop, 136 x 200 ft., estimated to cost $70,000.

The Imler Supply Co., Pittsburgh, manufacturer of dairy machinery and supplies, has acquired the property of the Lutz Brewery, 150 x 240 ft., consisting of a main seven-story building and three adjoining structures, and will remodel and improve the property for a new plant.

The Savage Fire Brick Co., Johnstown, Pa., F. W. Minch, secretary and treasurer, has plans for new works in the vicinity of Meyersdale, Pa., with main building one-story, 75 x 300 ft., estimated to cost $50,000.

The Board of Allegheny County Commissioners, Court House, Pittsburgh, has plans for a new two-story and basement shop, 70 x 330 ft., at the County Workhouse, Parkview, near Pittsburgh, estimated to cost $200,000 with equipment.

Chicago

CHICAGO, Sept. 24.

AFTER several weeks of extreme quiet, machine tool business shows some signs of revival. Inquiries are more numerous and additional railroad business is in prospect. The Chicago, Burlington & Quincy is expected finally to close against its pending list within the next ten days. In addition it has put out an inquiry for a motor-driven universal grinding machine, 60 in. between centers. The Illinois Central has asked for prices on four machines. The Chicago & North Western and the Chicago, Rock Island & Pacific are taking figures for 1924 budget purposes. The American Steel & Wire Co. is inquiring for a turret lathe and a radial drill for its Illinois plants. The Pullman Co. is in the market for a hack saw in addition to the list which it issued some weeks ago. The All-Steel Equip Co., Aurora, Ill., inquiring for a hand-operated screw press similar to a Walsh No. 2. The Leonard Tractor Co., Gary, Ind., contemplates the purchase of a planer.

A number of fair-sized orders have been booked by local machine tool houses recently. The Rockford Lathe & Drill Co., Rockford, Ill., has purchased three No. 2½ milling machines, a 2½-ft. and a 4-ft. radial drill and a horizontal boring mill. The American Maize Products Co., Chicago, has purchased a used vertical 60-in. boring mill and a used 6-ft. radial drill for its plant at Roby, Ind.

Illinois Central List

One motor-driven 2½-in. double bolt cutter complete with standard equipment.

One 20-in. motor-driven upright high-speed drill with power feed.

One 300-lb. helve-type power hammer suitable for general, medium and light blacksmith work.

One 20-in. x 10-ft. heavy duty engine lathe with taper attachment and with 16-in. 4 jaw independent steel chuck fitted, and with motor drive, including motor arranged for 440-volts, 50-cycle, three-phase, alternating current.

The Yellow Cab Mfg. Co., Austin and Dickens Avenues, Chicago, has let a contract for a one-story power house, 53 x 63 ft., at 2009-13 Austin Avenue, to cost $60,000.

William H. Vallas, Jr., manufacturer of sheet metal work, 4811 West Lake Street, Chicago, will build a one-story addition, 25 x 100 ft., at 4825 West Lake Street, to cost $6,000.

The Goss Printing Press Co., 1538 South Paulina Street, Chicago, has awarded contract for a four-story addition, 92 x 100 ft., at the southeast corner of Wood Street and Fifteenth Place, to cost $250,000.

The Chicago Concrete Post Co., 9 West Illinois Street, Chicago, has purchased the former plant of the Continental Chemical Works, at 4701-23 North Lamon Avenue, 125 x 347 ft.

Ground has been broken for an addition to the plant of the Standard Body Co., Angola, Ind.

The Bortner Mfg. Co., manufacturer of plumbing supplies, 3504 West Lake Street, Chicago, has leased manufacturing space in the building formerly occupied by the Anhydrous Food Products Co., at the corner of Stanley Street and Lakeside Avenue, North Chicago, Ill.

The Danly Machine Specialties, Inc., 4911 Lincoln Avenue, Chicago, formerly a division of Ludwig & Ludwig, was recently organized as a separate corporation. It will continue to operate at its old location and is not in the market for additional equipment at present. Officers are R. C. Danly, president; P. H. Danly, vice-president; G. I. Danly, secretary and treasurer.

The West Douglas Welding & Boiler Works, under the management of C. Regez, has been opened for business in Freeport, Ill. Equipment has been installed for welding and boiler repair work.

The Illinois Electric Power Co. is constructing an electric power plant at Peoria, Ill., to cost $3,500,000.

The National Plate Glass Co., a subsidiary of the General Motors Corporation, which is erecting a plant at Ottawa, Ill., recently took bids on the super-structure of a pot house and a machine shop unit.

The Waller Mfg. Co. has added a brass and aluminum foundry to its plant at East Dubuque, Ill.

The Woodmanse Mfg. Co., machinist and founder, Freeport, Ill., is adding another story to its west building at the cost of $10,000. The general offices and display room are to be located on the second floor and the machine shops in that building will be extended into the space now occupied by the offices.

The Lindell Drop Forge Co., Lansing, Mich., has awarded contract for a forging plant, 60 x 300 ft. The company will confine its production to forgings of light and medium weight, which can be handled by board hammers exclusively.

The Reo Motor Co., Lansing, Mich., has started the construction of an addition which will double the size of its power plant.

The International Lamp Corporation, 736 West Monroe Street, Chicago, contemplates the erection of a new plant on four acres recently acquired in Cicero, Ill.

The Burr Co., Champaign, Ill., manufacturer of castings and fabricated steel specialties, has been purchased by G. S. Burtis, H. B. Morrow and Robert Beaird. Mr. Burtis is president of William Garrigue & Co., chemical engineers, Chicago, Mr. Beaird is president of the Robert Beaird Corporation, industrial engineer, Chicago, and Mr. Morrow was formerly superintendent of the tractor works of the International Harvester Co.

The Citizens Gas & Electric Co., Waterloo, Iowa, has arranged an expansion program calling for an expenditure of $1,000,000, including work now in progress. Additional electric equipment to be installed will cost $300,000; hydroelectric power station at Cedar Falls, $200,000; Waterloo River power plant, $125,000; with remainder of the fund for power dam construction and miscellaneous work.

The Minnesota-Edison Co., St. Cloud, Minn., has been organized by Frank H. Hughes, St. Cloud, and associates, with capital of $11,000,000. It will take over existing power properties in this section, including the electric generating plant and system at St. Cloud, and contemplates the construction of additional power plants and transmission lines.

The Consumers Power Co., Osage, Iowa, will install additional equipment at its local steam-operated electric generating plant to double approximately the present capacity.

The Colonial Steel Co., 211 West Lake Street, Chicago, has awarded a contract to the Austin Co., 208 South La Salle Street, for a new one-story building at 1440-42 Bryan Place, 50 x 120 ft., estimated to cost $25,000.

The Common Council, Shelbyville, Ill., is planning for the installation of electrically-operated pumping machinery in connection with improvements in the waterworks system. The W. A. Fuller Co., 1917 Railway Exchange Building, St. Louis, is engineer.

The Minnesota Sugar Co., Metropolitan Bank Building, Minneapolis, Minn., is considering plans for the construction of a new beet sugar mill in the vicinity of East Grand Forks, Minn., with power plant, estimated to cost $1,200,000, with machinery. H. A. Douglas is president.

Manual training equipment will be installed in the two-story and basement high school to be erected at Mandan, N. D., estimated to cost $150,000, for which bids have been asked on a general contract. G. R. Horton, Jamestown, N. D., is architect.

The Western Public Service Co., Chadron, Neb., will make extensions and improvements in its local power plant to cost $25,000, including equipment.

Buffalo

BUFFALO, Sept. 24.

PLANS are being arranged by the International Paper Co., Buffalo Avenue, Niagara Falls, N. Y., for a steam-operated power house, estimated to cost $200,000 with equipment.

J. K. Fisher, 1095 Sycamore Street, Buffalo, is planning to purchase sheet-metal working machinery.

The Morrison & Risman Co., Bailey Avenue and Broadway, Buffalo, operating a general iron and steel works, is planning for the installation of a friction saw, Ryerson type; roller table, 120 ft. long, and other apparatus.

The American Kardex Co., North Tonawanda, N. Y., manufacturer of filing equipment, has acquired about two acres adjoining its plant for the erection of an addition, to utilize a portion of the site.

Cole Brothers, Lockport, N. Y., will install a machine shop in their two-story automobile service building, 55 x 90 ft., for which bids are being asked on a general contract. It will cost about $35,000. Nichols & Gardinier, 46 North Pearl Street, Albany, N. Y., are architects.

The Kroehler Mfg. Co., Ely Street, Binghamton, N. Y., manufacturer of furniture, is planning the erection of an addition to cost close to $100,000, including machinery. Headquarters of the company are at Naperville, Ill.

The Standard Thermometer Co., Ithaca, N. Y., has acquired the Dunn-Salmon Building, Syracuse, N. Y., for a new plant and will remove to the new location and install additional equipment.

The Union Carbide Co., Union Street, Niagara Falls, N. Y., has plans for a one-story addition, 75 x 160 ft., to cost $50,000, including equipment.

Fire, Sept. 16, destroyed a portion of the power house and machinery at the plant of the Fredonia Laundry Co., Water Street, Fredonia, N. Y., with loss estimated at $40,000. It is planned to rebuild.

Arthur W. Kreinheder, commissioner of public works, Buffalo, will receive bids until Oct. 23 for equipment for a filter plant at the municipal waterworks, including gages, rate controllers, feed devices, meters, etc. Fuller & McClintock, 170 Broadway, New York, are consulting engineers.

The General Abrasive Co., College Avenue, Niagara Falls, N. Y., has commenced the erection of an addition to cost $20,000.

The Batavia Iron Works, Inc., Batavia, N. Y., organized by James F. Fergsuon and Frederick W. Allen, Buffalo, operating a local iron and steel works, has acquired the plant of the Batavia Car Works, Inc. The new owner will make improvements for the resumption of production, including car wheel manufacture, etc. Mr. Ferguson is president of the company and Mr. Allen secretary and treasurer.

A machine shop will be installed in the two-story automobile building, 60 x 200 ft., to be erected at Oneonta, N. Y., estimated to cost $75,000, for which plans are being prepared by G. L. Tupper, 204-5 Lane Building. The owner's name is temporarily withheld.

Electric power equipment, transmission, conveying and other machinery will be installed in the new plant of the duPont Cellophane Co., a subsidiary of the E. I. du Pont de Nemours & Co., Buffalo, N. Y., for which foundations are under way on the River Road. The plant will be devoted to the production of transparent cellulose products and is estimated to cost $2,000,000 with machinery. L. A. Yerkes is president, and B. M. May, vice-president and treasurer.

Detroit

DETROIT, Sept. 24.

TENTATIVE plans are being considered by the McLean Motor Co., 1103 Military Street, Port Huron, Mich., for new works for the manufacture of automobiles and parts. Harvey Dixon is president.

The Detroit Auto Body Corporation, Detroit, recently organized to take over the automobile body manufacturing plant of the Andrew C. Sisman Co., Beaufait Street and St. Paul Avenue, has tentative plans for the purchase or erection of additional property for increase in output. A stock issue of $900,000 is being sold, a portion of the proceeds to be used for expansion.

Following the sale of its can and tube manufacturing departments to the Continental Can Co., 61 Broadway, New York, the National Can Co., 2566 East Grand Boulevard, Detroit, is arranging facilities at its local plant for the manufacture of automobile radiators exclusively. Present buildings will be retained and additional equipment provided in the vacated departments for increase in output. The Continental company is arranging for expansion to accommodate the necessary increased manufacture of cans and tubes.

Thomas G. Cranwell is president of the last noted organization.

The Ford Motor Co., Highland Park, Mich., is planning the construction of three new units at its body manufacturing works at Iron Mountain, Mich., to cost in excess of $700,000 with machinery. It has acquired property on the Western Parkway, Louisville, and plans the construction of a new assembling plant estimated to cost $600,000 with equipment.

New interests, headed by O. O. Schulz and Charles Hueman, have acquired the plant and business of the Jackson Motor Shaft Co., Jackson, Mich., heretofore operated as a unit of the Earl Motors Corporation, for $500,000. The company will be reorganized and has plans for development in the manufacture of crankshafts, camshafts and kindred products. Mr. Schulz will be president of the new company and Mr. Hueman, secretary; Frank Stiente will be plant superintendent.

Manual training equipment will be installed in the two-story and basement high school addition to be erected at Birmingham, Mich., estimated to cost $125,000. Van Leyen, Schilling, Keough & Reynolds, 3440 Cass Avenue, Detroit, are architects.

The Wills Sainte Claire Motor Co., Marysville, Mich., is perfecting plants for the establishment of a new factory branch at Detroit, and has leased a portion of the Sievers & Erdman Building, Beaubien and East Jefferson Streets. A service and machine repair works will be located in the building at Larned and Rivard Streets.

The Common Council, Marquette, Mich., is arranging a special election to vote bonds for $100,000, for a municipal electric generating plant on the Dead River. Orbison & Orbison, 812 College Avenue, Appleton, Wis., engineers, will prepare plans.

The Olds Motor Works, Inc., Lansing, Mich., is making extensions at its local plant for large increase in production. It is expected to install facilities for about 1000 additional workers. John Scott is plant manager.

The Wilson Foundry & Machine Co., South Saginaw Street, Pontiac, Mich., has awarded a contract to the Bryale Construction Co., Crofoot Building for a two-story and basement addition, including improvements in the present works, to cost approximately $400,000, with machinery. C. B. Wilson is vice-president. Mills, Rhines, Bellman & Nordhoff, Ohio Building, Toledo, are architects.

Manual training equipment will be installed in the new two-story senior and junior high school to be erected at Owosso, Mich., estimated to cost $500,000, for which bids will be called at an early date on a general erection contract. Lane, Davenport & Peterson, Charlevoix Building, Detroit, are architects.

Milwaukee

MILWAUKEE, Sept. 24.

LITTLE change is noted in the character or volume of the demand for machine-tools. Scattering sales are being made from day to day, but in general the market remains quiet. Automotive industries continue the best buyers and still their immediate needs are of rather scant proportions. Used machinery is in perhaps better demand than new, and the supply is fairly large, being augmented from time to time by lots growing out of liquidation of plants. A notable example is the Mitchell Motors Co. of Racine, the trustee of which in the past week or two has sold a relatively enormous quantity of miscellaneous machinery.

The Glancy Malleable Corporation of Waukesha, Wis., has taken over a part of the former Samson Tractor Co. works at Janesville, Wis., and is buying considerable new and used equipment. An order for seven presses and four drophammers has been placed with the Rockford Iron Works, Rockford, Ill. The Janesville unit will serve as the finishing plant for the malleable foundry conducted by the Glancy company at Waukesha, which is occupied with orders for parts for various automobile plants.

Carl Otto, Watertown, Wis., has engaged R. A. Phillips, architect, Beaver Reserve Building, Madison, Wis., to design a public garage, with machine and service shop, 60 x 150 ft., two stories and part basement, estimated to cost $35,000. Foundations will be laid this fall.

The Milwaukee Coke & Gas Co., 187 Greenfield Avenue, Milwaukee, is awarding contracts for buildings and equipment for a new benzol distillery and refinery in connection with its main works, which will replace a unit destroyed by explosion and fire on Aug. 1. The cost is estimated at $250,000. J. W. Schaeffer is president and general manager.

The Nash Motors Co., Kenosha, Wis., will build another addition to its four-cylinder passenger car works on Clement Avenue, Milwaukee. It will be 200 x 600 ft., 26 ft. high of brick and steel, and will be known as a loading building. The general contract has been let to Theodore Stark & Co., 130 Muskego Avenue, Milwaukee.

The Palmolive Co., 42-60 Fourth Street Milwaukee, will build a branch soap, toilet goods and chemical works at Newark, N. J., the investment to be upward of $1,000,000. Plans will be completed at once and purchases of machinery and equipment made shortly. A complete machine and service shop will be provided. Caleb E. Johnson is president.

The general contract for a new machine shop and automotive service station for Jim's Repair Shop at Fifteenth and Galena Streets, Milwaukee, has been let to the Byrne Brothers Co., 3112 Burleigh Street, by Frank Howend, architect, 65 Wisconsin Street. With equipment now being contracted for, the cost will be about $25,000.

The Cedar Grove Shoe Mfg. Co., Cedar Grove, Wis., is buying shoe machinery, motors, etc., for a two-story addition, 38 x 144 ft., designed by Dick & Bauer, architects, 811 State Street, Milwaukee. Bids for the construction work closed Sept. 22.

The L. F. Schoelkopf Co., Ford distributor, 210 East Washington Avenue, Madison, Wis., is taking bids this week through Small & Flad, architects, for a four-story addition, 43 x 83 ft. The upper floors will be added to the service department and machine shop, for which additional equipment will be purchased.

The Lakeside Bridge & Steel Co., North Milwaukee, is in the market for a rotary planer, 36 to 48-in. head, with or without turntable.

Cleveland

CLEVELAND, Sept. 24.

LOCALLY, the market is quiet and sales confined for the most part to single machines. The Humphrey Mfg. Co., Mansfield, Ohio, which will build a new foundry and machine shop, as reported last week, has sent out an inquiry for about ten standard machine tools and for a 5-ton and 7½-ton electric traveling crane. Manufacturers of automatic screw machinery report an improvement in orders for from one to three machines, but business with machine tool builders in some other lines is lighter than a few weeks ago. Some business is pending in the Detroit automotive field, including machinery requirements for the Rickenbacker Motor Co., which is planning to double its output.

The Japanese Government is inquiring for machinery for rebuilding arsenals destroyed in the earthquake. Inquiries for automatic screw machines have reached agents of American machinery houses in Japan and have been cabled to this country. So far, they have been rather indefinite. Manufacturers may await actual orders from the Japanese Government or may decide to consign machinery to their Japanese agents with the expectation that they will receive orders later. In addition, inquiry has also come from Japanese houses in New York for punching and shearing machinery with a view of finding what manufacturers have in stock and lining up equipment to fill any orders that they may secure from Japan.

The Templar Motor Car Co., Cleveland, has been organized to take over the Templar plant which for some time has been in receivership. T. L. Hausmann, receiver, is president of the new company. None of the members of the former Templar organization is affiliated with the new organization, which will have a capital stock of $2,500,000 in preferred stock and 100,000 shares of no par common stock.

Baker Brothers, Toledo, Ohio, have placed contract for the erection of a two-story machine shop.

The Elyria Foundry Co., Elyria, Ohio, a subsidiary of the Brown Hoisting Machinery Co., has purchased the adjoining plant of the Elyria Machine Co. and will use it for enlarging its foundry capacity. It includes a machine shop, about 150 x 160 ft., which will be used for a foundry and a shell shop, 60 x 300 ft., which will be converted into a pattern storage department. The plant of the Elyria Machine Co. has not been operated for a long time and its machinery equipment was recently sold at auction.

The Pioneer High Speed Machine Knife & Tool Co., which will establish a plant in Cleveland for the manufacture of machine knives, has been incorporated with a capital stock of $10,000 by C. G. Willis and others.

The Citizens Necessity Co., 614 Virginia Street, Toledo, Ohio, is contemplating the erection of a new cold storage plant to cost approximately $350,000, with machinery. Plans will be prepared early next year. J. Murphy is president.

The Vannette Sons Co., Tiffin, Ohio, recently organized, has acquired property for the establishment of a new plant to manufacture lawn mowers and kindred hardware products.

Indiana

INDIANAPOLIS, Sept. 24.

ABOUT 130 acres at Gary, Ind., has been taken over by the American Steel & Wire Co., 208 South La Salle Street, Chicago, as a site for a new plant. It is stated that the project will involve more than $400,000 and that plans will be prepared for building early next year.

Manual training equipment will be installed in the new two-story and basement high school to be erected at Connersville, Ind., estimated to cost $250,000, for which excavations will be made at once. E. E. Dunlap & Co., State Life Building, Indianapolis, are architects.

The Craft Co., Wulsin Building, Indianapolis, manufacturing jeweler, has leased space in the Jackson Building, and will remove to this location. Additional precision machinery will be installed.

Thomas L. Green & Co., 202 Miley Avenue, Indianapolis, manufacturers of bakers' machinery, have plans for a one-story addition estimated to cost $37,000. Charles E. Bacon, 605 I. O. O. F. Building, is architect.

The Public School Board, Indianapolis, will break ground for a new technical high school with vocational department, estimated to cost $100,000.

The Board of Commissioners, Crown Point, Ind., will take bids for a plant for electric light and power service at its proposed sanitarium estimated to cost $350,000. Karl D. Morris, Calumet Building, East Chicago, Ind., is architect.

The C. & G. Pattern Works, 233½ East Maryland Street, Indianapolis, has acquired the plant and business of the Modern Brass Foundry Co., 1026 Kentucky Avenue, consisting of a two-story building, 145 x 145 ft. The new owner will remove the pattern works to the latter location and will merge the plants. Plans are under way for expansion in both departments, with foundry to specialize in the manufacture of automotive products. Charles J. Gisler is president and general manager and Fred D. Crider, secretary.

The Toledo, St Louis & Western Railroad has let contract to Bierd, Lydon & Grandpre, Inc., 340 West Harrison Street, Chicago, for the construction of a 27-stall roundhouse at Frankfort, Ind., to cost about $300,000.

Cincinnati

CINCINNATI, Sept. 24.

ORDERS were more numerous in the machine tool industry last week. A St. Louis manufacturer is reported to have booked a number of machines, some of which were for Cincinnati manufacturers. The Pennsylvania Railroad is placing orders for its Eastern shops, and equipment is being bought for the Harrisburg shops. The list of tools for the Central and Western regions, over 30 in number, has not been placed as yet, but orders will probably go out this week. Some buying by automobile manufacturers is also reported, but the volume is light. Inquiries are increasing for one and two machines.

Railroad buying is expected to develop this fall. The Big Four has issued an inquiry for two large machines and is expected to have another out shortly. The Louisville & Nashville Railroad, the Chesapeake & Ohio and the Southern Railroad are also reported to be considering the purchase of equipment for various shops. Local dealers report a slightly improved demand from machine shops in this district, although the inquiries generally run to small tools. A Philadelphia manufacturer placed an order for four engine lathes this week, two of which were booked by a Cincinnati builder. Used tools are in improved demand.

A tractor manufacturer in this district reports the receipt of an order for a number of machines for shipment to South America and Australia. Japanese interests also have been buyers during the past two weeks.

The Ohio Edison Co., Springfield, Ohio, is contemplating the erection of a 12,500-kw. power plant along the Mad River, work on which is expected to start next spring.

The Standard Sanitary Mfg. Co., Louisville, Ky., is having plans drawn for an addition to its pattern shop to cost $40,000. D. X. Murphy & Bros. are the architects.

The Hamilton Press & Machinery Co., Hamilton, Ohio, has been organized with a capitalization of $100,000 to manufacture power presses and machine tools. The incorporators are Gordon S. Rentschler, Thomas A. Dorsey, Henry A. Rentschler, John H. Black and W. C. Shepherd. Manufacturing operations will be carried on in the plant of the Hoover, Owens & Rentschler Co., and no new works are contemplated in the immediate future.

Manual training equipment will be installed in the new high school to be erected at Sylvania, Ohio, estimated to cost $150,000, for which plans are being prepared by T. McLaughlin and associates, Citizens Building, Lima, Ohio.

The William Powell Co., 2525 Spring Grove Avenue, Cincinnati, manufacturer of valves and steam specialties, has awarded contract to the Ferro Concrete Construction Co., Third and Elm Streets, for a three-story and basement addition, 45 x 160 ft., and improvements in present plant, estimated to cost $150,000.

The Central South

ST. LOUIS, Sept. 24.

CONTRACT has been let by the Heine Boiler Co., 5313 Marcus Street, St. Louis, to the Fruin-Colnon Construction Co., Merchants Laclede Building, for a one-story addition, 80 x 140 ft., to be equipped as a machine and boiler shop, estimated to cost $55,000. Lichter & Jens, St. Louis, are architects.

The Common Council, New London, Mo., plans the installation of electrically-operated pumping machinery in connection with a new municipal waterworks, estimated to cost $35,000. W. B. Rollins & Co., Railway Exchange Building, Kansas City, Mo., are engineers.

A power house will be installed by the Jefferson Cotton Mills Co., Pine Bluff, Ark., recently organized in connection with its proposed mill. The complete machinery installation is estimated to cost $250,000.

The Arkansas Bauxite Products Co., P. O. Box 381, Little Rock, Ark., recently organized, is planning the construction of a new factory to manufacture alum and kindred products, estimated to cost $75,000, of which about $40,000 will be expended for machinery and electric power equipment. G. W. Goodman is secretary.

Manual training equipment will be installed in the new high school to be erected at Burlingame, Kan., estimated to cost $95,000, for which bids will soon be asked on a general contract. W. E. Glover, Stormont Building, Topeka, Kan., is architect.

The St. Louis Coffin Co., 1821 Choteau Avenue, St. Louis, will commence the erection of an addition, 125 x 160 ft., estimated to cost $55,000. E. J. Hass, 3228 Magnolia Avenue, is architect.

The Border City Ice & Cold Storage Co., Fort Smith, Ark., has inquiries out for a steam boiler, about 500 hp., and auxiliary equipment.

The Common Council, Owensboro, Ky., plans the installation of electrically-operated pumping machinery in connection with proposed extensions at the waterworks plant, for which a bond issue of $100,000 is being arranged.

The Fred Medart Mfg. Co., Second and Potomac Streets, St. Louis, manufacturer of steel lockers, shelving and kindred equipment, has awarded a general contract to the Woermann Construction Co., Syndicate Trust Building, for a one-story addition, 130 x 260 ft., estimated to cost $100,000, including equipment.

A power house will be constructed at the proposed textile mill of the Tulsa Cotton Mills Co., Tulsa, Okla., recently organized, estimated to cost $200,000. The Southwest Engineering Co., Tulsa, architect and Daniel Hunt president.

The Duncan Machinery Co., P. O. Box 265, Knoxville, Tenn., machinery dealer, has inquiries out for a double-cylinder, single drum hoisting engine with auxiliary equipment; also for a hoisting engine for mining service, single drum, to handle about 1900 ft. of ¾ in. cable.

Carl Willms, Jr., Erwin, Tenn., is in the market for a box car loader, about 10 ft. long, electrically operated.

The Louisville Petroleum Refining Co., Louisville, has selected a site on the Ohio River for a new oil refinery with initial output of about 2500 bbl. per day, estimated to cost $300,000, including machinery. W. M. Mitchell is president.

A cold storage and refrigerating plant, with steel ovens, conveying and other machinery will be installed in a five-story and basement addition to be erected by the Gould Cracker & Candy Co., Kansas City, Mo., to cost about $125,000, including equipment. Shepard & Wiser, 1202 R. A. Long Building, are architects.

The Trenton Cotton Oil Co., Trenton, Tenn., has been organized with a capital of $100,000 to take over the cotton oil mill of the American Cotton Oil Co., recently acquired by R. H. Baker and L. P. Brown, both of Memphis, Tenn., who will head the new company. The same owners have purchased the American Cotton Oil Co. refinery at Memphis for $75,000, and will convert this property for an oil mill machinery works, including repair and used equipment de-

partment. R. H. Patterson, Trenton, Tenn., is also interested in the new organization.

Manual training equipment will be installed in the new senior and junior high school to be erected at Warrensburg, Mo., estimated to cost $185,000, for which excavations will be made at once. J. H. Felt & Co., Kansas City, Mo., are architects.

The Empire Companies, Inc., Bartlesville, Okla., has commenced the construction of a new gas compressing plant at Cambridge, Kan., with capacity of 40,000,000 cu. ft. per day, estimated to cost $90,000. Four gas engines, compressors and auxiliary equipment will be installed.

The Kansas City Light & Power Co., Grand Avenue, Kansas City, Mo., has plans for a one-story automobile service and repair building, 160 x 180 ft., at Ninth and Charlotte Streets, for company motor trucks and cars, estimated to cost $95,000, with equipment.

The Gulf States

BIRMINGHAM, Sept. 24.

BIDS will be received by the supervising architect, Treasury Department, Washington, until Oct. 16, for a power plant with complete equipment, and refrigerating equipment, for the National Home for Lepers, Carville, La.; also for one engine-generator.

W. M. Smith & Co., P. O. Box 1709, Birmingham, have inquiries out for an air compressor, 80-hp. boiler, and auxiliary equipment.

The Gadsden Ice & Fuel Co., Gadsden, Ala., recently organized with a capital of $150,000, will take over and expand ice-manufacturing plants on local site and at Attala, Ala. Otto Agricola is secretary.

The Dallas Power & Light Co., Dallas, Tex., has arranged for an increase in capital from $3,500,000 to $4,500,000, a portion of the proceeds to be used in connection with a new local electric generating plant.

Manual training equipment will be installed in the new senior high school to be erected at Denton, Tex., estimated to cost $150,000, for which excavations will soon be made. The Board of Education is in charge.

Work is in progress on the erection of a new cotton oil mill at Lubbock, Tex., and equipment to provide for an output of 110 tons a day will be installed. The plant will be owned and operated by the Lubbock Cotton Oil Co., and is estimated to cost $275,000, including equipment.

The Common Council, Bayou la Batre, La., is interested in a project to build a municipal ice-manufacturing plant, to cost about $50,000 with equipment.

Plans are under way for the installation of electrically-operated pumping machinery in connection with a waterworks plant at White Springs, Fla., estimated to cost $30,000. The Common Council is in charge.

V. K. Bessonette, P. O. Box 191, Waco, Tex., has plans under way for the establishment of a plant to manufacture electric storage batteries.

The Desdemona Electric Co., Desdemona, Tex., is planning for the installation of additional equipment, including oil-operated engine, electric generator, switchboard and auxiliary machinery.

Edward Tucker, Ocala, Fla., is planning the construction of a one-story automobile service building, 110 x 200 ft., with machine shop, estimated to cost $50,000 with equipment. A. C. Price, Bradentown, Fla., is architect.

The J. Decker & Sons Sales Co., Dallas, Tex., meat packer, has commenced the construction of a new cold storage plant at Griffin and Laws Streets, estimated to cost $60,000, including equipment.

The Florida Food Products, Inc., P. O. Box 96, Stuart, Fla., is planning the construction of an electric power house, and will make inquiries for equipment at once. A refrigerating plant will also be installed. The company was organized recently with a capital of $500,000.

The Weekers Auto Parts Co., New Orleans, is planning to rebuild the portion of its works at Carondelet and Erato Streets, recently destroyed by fire with loss estimated at $50,000.

The Magnolia Carbon Co., Monroe, La., recently organized with a capital of $500,000, is planning the construction of a gasoline refinery in connection with its proposed carbon plant. The entire works will cost $400,000, including machinery. W. L. Ethridge, secretary, will be in charge of all equipment purchases. W. H. Price, Swartz, La., is construction engineer.

The Indiana Truck Corporation, Miami, Fla., is planning to rebuild the portion of its service and repair building at 316 South Miami Avenue, recently destroyed by fire with loss estimated at $55,000.

The Valley Ice & Electric Co., McAllen, Tex., will install electrically-operated pumping machinery at the local waterworks.

The Dyer Mfg. Co., Bell, Cal., is inquiring for an 8-ft., 10-gage power brake, similar to Keenes.

Canada

TORONTO, Sept. 24.

INQUIRY for machine tools continues a strong feature in this market. Buying, however, is chiefly confined to small lots and preference is shown for labor and time saving equipment. Second hand and rebuilt machine tools are in good demand.

The Marvel Equipment Co. of Canada, a subsidiary of the Marvel Equipment Co., Cleveland, Ohio, manufacturer of portable outfits, oil and grease pumps, etc., will establish a fatcory at Belleville, Ont.

The General Motors Corporation of Canada, Oshawa, Ont., is building an assembling plant on Division Street to cost $300,000.

The Town Council, Cochrane, Ont., will install a sewage disposal plant to cost $25,000. Work will be done under the supervision of the town engineer, who will purchase all equipment.

The Alberta Granite & Marble Works, Edmonton, Alberta, is having plants prepared for a factory on 101st and 107th Streets, to cost $10,000.

Plans are being revised for the erection of a new foundry for the Canadian Westinghouse Co., Aberdeen Street, West, Hamilton, Ont.

The B. C. B. Berry Growers' Union, New Westminster, B. C., will build a cold storage plant to cost $75,000.

D. Bell, Collingwood, Ont., has the general contract for the erection of a plant for the Canadian Postal Lock-Nut & Bolt Co.

The Harbor Commission, Montreal, is erecting a machine shop to cost $40,000.

Plans are being prepared for a paper mill at St. Catherines, Ont., for the Garden City Paper Co., Merriton, Ont., to cost $400,000. W. J. Trible, 54 University Avenue, Toronto, is engineer and general contractor.

An addition to the power plant at Yorkton, Sask., to cost $63,000 is contemplated. It will include the purchase of two 300 hp., Mirrless Bickerton and Day Diesel engines, two generators, and other equipment.

The Municipal Electric Light & Power plant at Melville, Sask., was destroyed by fire with a loss of $100,000.

The plant of the International Fibre Board Co., Ltd., Penetanguishene, Ont., was destroyed by fire with a loss of $150,000.

The Canadian Roofing Co., Winsdor, Ont., is making arrangements for the erection of a new manufacturing plant to replace that recently destroyed by fire and is interested in equipment.

Construction work is under way on the erection of an addition to the plant of the Pendrith Machinery Co., 970 Queen Street, West, Toronto. The Dowling Construction Co., Yonge Street, Toronto, has the general contract. Some equipment has yet to be purchased.

The W. & C. Window Regulator Co., Chesley, Ont., is contemplating the erection of a manufacturing plant to cost $100,000 for the manufacture of a patent window regulator. R. J. Ranney, manager, is inquiring for equipment.

The Ottawa River Power Co., Ltd., 145 St. James Street, Montreal, is in the market for power and transmission equipment and machinery.

The Universal Wheel Co., Ltd., Windsor, Ont., has leased the building formerly occupied by the Universal Button Co., and will commence the manufacture of disk automobile wheels.

Construction will start at an early date on a gas plant for the Winnipeg Electric Railway, Winnipeg, Man. It will cost approximately $1,000,000 and will be equipped with the latest machinery.

Dustless Sifters, Ltd., Brantford, Ont., is in the market for equipment to manufacture ash sifters, fuel saving devices, etc. I. Lunenfeld is the purchasing agent.

The E. B. Myers Co., Ltd., Montreal, will make purchases for the manufacture of radio equipment, etc. F. Callaghan, 222 St. James Street, Montreal, is receiving quotations.

Firstbrook Brothers, Ltd., Toronto, has purchased a site on

Caledonia Road, and will erect a factory for the manufacture of builders' supplies, etc.

The De Laval Co., Peterborough, Ont., will build addition to its plant for the manufacture of cream separators.

The Pacific Coast

SAN FRANCISCO, Sept. 19.

NEGOTIATIONS are under way between the Paramount Motors Co., Azusa, Cal., and city officials for a site for the construction of a new plant to manufacture automobiles. The company agrees to expend at least $100,000 for the works, including equipment.

The United States Steel Products Co., Los Angeles, has awarded a contract to Gutleben Brothers, 609 I. W. Hellman Building, for the erection of a one-story distributing plant and works, 300 x 400 ft., at Vernon, Cal., with one-story office, 50 x 100 ft. Hoisting, conveying and other equipment will be installed.

The Washington Water Power Co., Spokane, Wash., has acquired the plant and property of the Okanogan Valley Power Co., and plans the erection of an addition to the hydro-electric generating station at Similkameen Falls, to increase the capacity about 2500 hp.

The Board of Public Works, Portland, Ore., is arranging an appropriation of $17,400 for the purchase of tools and equipment for installation in the new four-story municipal shop and warehouse to be erected at Fourth and Market Streets, to cost $35,900 exclusive of machinery.

The Pacific Portland Cement Co., Pacific Building, San Francisco, has tentative plans for a new cement mill in the vicinity of Redwood City, Cal., with power plant, to cost $700,000 with machinery.

S. G. Beach & Son, Placerville, Cal., are planning for extensions in their box factory, including the installation of electric power and other machinery, to cost $30,000. A new company is being organized to take over and expand the company, in which Seth G. Beach, head of the present company, will be interested.

The Oakland Foundry & Furnace Co., Oakland, Cal., is arranging for the removal of its plant to a new site acquired on Third Street, West Berkeley, Cal., where operations will be considerably extended to cover the manufacture of a patented furnace, and operation of a general commercial foundry. Officers of the company are interested in the Newman Pattern Works, Oakland, and this plant will be removed also to the new location and operated jointly with the foundry. John Newman heads both organizations; John E. Hyatt, mechanical engineer, is secretary and treasurer.

The Pacific Power & Light Co., Portland, Ore., is planning the construction of a new power house at Pendleton, Ore., to cost $140,000 including equipment.

The Pacific Gas & Electric Co., 445 Sutter Street, San Francisco, operating hydroelectric and other power plants in northern California, will issue bonds for $10,000,000, a portion of the proceeds to be used for extensions. Work will soon commence on a new steam-operated power plant on Stevenson Street, estimated, to cost $250,000 with machinery.

The Santa Fe Railway Co., Kerchkoff Building, Los Angeles, has awarded a contract to Robert E. McKee, El Paso, Tex., for a new pipe and tin-working shop at San Bernardino, Cal., to cost $55,000.

The Common Council, Seattle, Wash., has approved an appropriation of $50,000 for extensions in the municipal steam-operated electric power plant, used for auxiliary service, to include the installation of superheaters, oil-burning system and other equipment.

STEEL AND INDUSTRIAL STOCKS

Market Remains Sluggish and Unsettled—Prevailing Tone Is Bearish

Industry has staged no autumn quickening to buoy stocks above the sluggish condition into which they have lapsed and from which the course of limited trading has made little departure. Steels revived at midweek, but the new strength waned later in the week. The conciliatory foreign mood could not prevail against domestic uncertainty. United States Cast Iron Pipe & Foundry displayed exceptional strength, obviously reflecting favorable earnings.

The range of active steel and industrial stocks from Monday of last week to Monday of this week was as follows:

	Low	High		Low	High
Allis-Chalmers...	39¾	42	Int. Har. new...	75½	76¾
Allis-Chalm. pf..	92½	93	Lima Loco.	62	63¾
American Can...	90⅛	93⅝	Midvale Steel...	25¼	26⅛
American Can pf.	107⅛	107⅝	Nat.-Acme	10¼	10½
Am. Car & Fdry.	155¼	158	Nat. En. & Stm.	55⅛	59
Am. Car & F. pf.	117	117	Nat. En. & S. pf.	97	97
Am. Locomotive.	68	70½	N. Y. Air Brake.	35½	37½
Am. Radiator...	80	80	Otis Steel	7⅞	8¼
Am. Steel Fdries.	35	36	Otis Steel pf....	49	49
Baldwin Loco...	112¾	117⅝	Pressed Stl. Car	48	52
Bald. Loco. pf...	113	113	Ry. Steel Spring.	99⅛	102
Bethlehem Steel.	47	49¾	Replogle Steel...	10¼	11½
Beth. pf. new...	91¼	92⅛	Republic	42¼	44¾
Beth. Stl. 8% pf.	105	106	Republic pf.....	87	87½
Br. Em. Steel...	6	6	Sloss	43	44
Br. Em. Stl. 2 pf.	16½	16⅝	Transue-Williams	31	31
Chic. Pneu. Tool	80	80¾	U. S. Pipe.....	29¾	34½
Colo. Fuel	25	27	U. S. Pipe pf....	74	78⅞
Crucible Steel...	58¼	62⅛	U. S. Steel.....	86⅝	89⅛
Gen. Electric....	167⅝	169½	U. S. Steel pf...	116⅞	117¼
Gt. No. Ore Cert.	26½	29¼	Vanadium Steel.	29	30
Gulf States Steel	74¾	79⅝	W'house Air Br.	80½	81
Inland Steel.....	32	33	Y'gstown S. & T.	65	67

Annual Meeting of Canadian Locomotive Co., Ltd.

The Canadian Locomotive Co., Ltd., Kingston, Ont., has unfilled orders to the extent of $2,300,000 and it was announced after the annual meeting that the plant had enough work on hand to keep it running well into next spring. F. G. Wallace of Pittsburgh, resigned the presidency, and Aemilius Jarvis was appointed to succeed him, also retaining the chairmanship of the board, William Casey, vice-president and general manager, and William Harty, Jr., secretary, were reelected, as were the directors.

The usual quarterly dividend of 1¾ per cent on preferred stock and 1 per cent on common stock was declared. In his statement to the shareholders, Mr. Jarvis, chairman of the board, pointed out that there had been a shut down of the plant for over 20 months and that very little profits from the new business had entered into the current year. Despite this the operating profits, together with the income from the investments, has enabled the company to show an operating profit for the year of $7,401 over the charges for the shut down period, leaving the surplus after payment of interest at $1,007,317. There were Victory bonds at cost to the amount of $1,040,760. The amount of the accounts payable including a bank loan of $750,000 was $1,273,920, whereas the current assets, cash, and investments amounted to $2,487,667. Since 1917 there has been an average net earning of $432,706 per annum.

Plans of New Companies

The C. G. Spring Co., 1819 Broadway, New York, has been incorporated with capital stock of $50,000 to manufacture automobile springs and bumpers. Plants are maintained at Kalamazoo, Mich., Detroit and Cleveland. Later the company expects to install facilities for manufacturing fittings. Christian Girl is president and A. C. Bergmann is New York manager.

The American Batteries, Inc., care of H. C. Curran, 111 Broadway, New York, has been organized with $1,500,000 capital stock to manufacture batteries. Its plant is located at Waco, Tex., and is now in operation.

The Eden Washer Corporation, Paterson, N. J., incorporated with capital stock of $325,000, will manufacture washing machines. The Robbins & Myers Co., Springfield, Ohio, will build the machines by contract. All jigs, tools and machinery of the new company are now being moved and production should begin about Nov. 1. Paul V. D. Brokaw is president.

The du Pont Cellophane Co. has been organized as a subsidiary of E. I. du Pont de Nemours & Co. and will build a $2,000,000 plant on the Niagara River at Buffalo. Cellophane, the chief product, is a cellulose substance. L. A. Yerkes is president; B. M. May, vice-president and treasurer; M. du Pont Lee, secretary.

Construction has begun on the new copper smelter at San Luis Potosi, Mexico, of the Towne Mines, Inc., recently organized by the American Smelting & Refining Co. to take over mines formerly owned by the Compania Metalurgica Mexicana. The smelter will have a capacity of 30,000 to 50,000 tons of charge per month and will cost approximately $1,500,000. The work of rehabilitating the Towne properties at Santa Barbara has begun, large pumping equipment now being installed. It is expected that the company will be ready for operation in the fall of 1924.

The Wright Machine Co., Worcester, Mass. has been incorporated with $250,000 preferred stock and 2500 shares, no par value, and will manufacture machine tool products.

It has purchased property formerly owned by the R. B. Phillips Mfg. Co., Worcester, and the American Steam Gauge & Mfg. Co., Boston.

The Florida Steel & Wire Co., Jacksonville, Fla., has been incorporated with $225,000 capital and will establish a plant for the manufacture of wire nails. It is understood the company may manufacture barbed wire and other fencing later on.

The United Metal Products Co., Canton, Ohio, has been organized to purchase the property formerly owned by the Central Metal Products Corporation. It will manufacture hollow metal doors and drawn steel and bronze moldings.

The Heateconomy Corporation, New York, has been incorporated with capital stock of $10,000 and will manufacture apparatus for oil burners. Manufacturing will be done by contract, a few hundred of the devices to be ordered immediately. Further details of operation are indefinite. Incorporators are E. T. Crepeau and J. A. Mallon. Address care of O. P. Carpenter, 154 Nassau Street, New York.

A. M. Kennedy & Co., Inc., New York, has been organized to manufacture printing presses and parts, but no manufacturing is contemplated at the present time. The company will act as distributor in these and kindred lines. Temporary offices will be located at 396 Broadway. Bernard Berger, 305 Broadway, is representative.

The Leff Electrical Co., Brooklyn, has been incorporated with capital stock of $20,000, to manufacture electrical specialties. Temporary headquarters are at Canarsie, Brooklyn. Manufacturing will not be undertaken at present. The company will confine its activities to electrical contracting. J. H. Leff, 499 Hart Street, Brooklyn, represents the company.

The Wallace-Lispenard Cotton Harvester Co., care of H. M. Wise, 7 Dey Street, New York, organized some time ago to manufacture cotton harvesting machinery has postponed manufacturing plans for the present. A few machines will be built for demonstration purposes and when quantity production is undertaken the work will be done by contract. Incorporators are L. H. Cohn and George Lispenard, Lispenard & Park, 250 Canal Street.

The Sar Vant-Weatherdon Co., 331 Madison Avenue, New York, has been organized to manufacture machinery. Plans for operation have not been perfected. The incorporators are W. N. Sar Vant, F. J. E. Weatherdon and C. D. Landry.

The New Matic Machine Corporation, New York, recently incorporated with capital stock of $50,000 to manufacture machinery, will establish its plant in New York. Equipment will be installed and operations will be under way as soon as possible. Address care of Levisohn, Niner & Levisohn, 13 Astor Place.

The King Partition Block Corporation, New York, has been incorporated with $15,000 capital stock, and will manufacture cement blocks. Plans are not definite. Frederick L. Keppler, formerly of the Keppler Blair Construction Co., who now is located at 1799 First Avenue, heads the company.

The Commerce Motor Truck Co. has been organized to continue the business of the Motor Car Co., Detroit. The new organization is headed by Walter Parker, who planned and directed the formation of the Commerce company.

The Great Eastern Sugar Co., incorporated to engage in an extensive sugar beet business on Long Island, has planned to erect a large factory. Kurt Grunwald, consulting agriculture engineer of Denver and Medford, L. I., is the principal organizer. The company is ready to spend $7,000,000 in this development. In connection with a colonizing plan the company has purchased 40,000 acres of land which will be equipped with necessary buildings and machinery.

The Goodwin Antipilferage Automatic Lock Corporation, Woolworth Building, New York, has been incorporated with $50,000 capital to manufacture locks. Negotiations are being made to have the work done by contract and the company wishes to communicate with firms equipped for this line. J. D. Jolkovski heads the company.

The Empire Block Corporation, Utica, N. Y., has been organized with $50,000 capital stock to manufacture cement blocks. It is a subsidiary of the Empire Wall Plaster Co., Utica. L. W. Kunkel, G. Hopp and J. Ferguson are the principals.

The Maximum Motors Corporation., 2 Rector Street, New York, incorporated several months ago to manufacture machinery, has built six motors with a new valve design and will continue testing operations for a few weeks. Manufacturing will be done eventually but plans are not yet being considered. C. Mackay, Room 1624, heads the company.

The Oil-O-Matic Heating Corporation, 439 Boush Street, Norfolk, Va., has been organized to handle automatic oil burners, oil burning equipment and oil. C. C. Carper is general manager.

The Tice Tinsley Steel Co., Terminal Building, Youngstown, Ohio, has been organized with $50,000 capital stock to succeed the Tice Steel Co., that city. The new company will deal in sheets, plates, strip and terne plate seconds, as well as surplus mill supplies. Charles A. Tice was formerly assistant general manager of sales of the Brier Hill Steel Co. George C. Tinsley was vice-president of the Commercial Shearing & Stamping Co., general manager of the sheet and tin plate department, David J. Joseph Co., Youngstown, and was for several years with the Sharon Steel Hoop Co., Sharon, Pa.

The Hoops-Wood Shipyard, Inc., Eightieth Street and Jamaica Bay, Rockaway Beach, N. Y., organized to operate a shipbuilding plant, will do repair work and overhauling. H. P. Woods and William Hoops are the principals.

The Electric Lumber & Mfg. Co., care of A. M. Crawford, Yeon Building, Portland, Ore., incorporated with capital stock of $40,000, will operate a plant making carbuilding material. The mill will be operated by 500-hp. motors. W. H. Richardson is president and A. M. Crawford, secretary.

The Royal Motor Coach Co., Inc., 285 Bloomfield Avenue, Caldwell, N. J., recently organized with $500,000 capital stock, will purchase equipment to provide for an initial capacity of production of automobiles.

The Baker Car Co., Lexington, Ky., recently organized with $50,000 capital stock, will build a factory and install machinery for the manufacture of mine cars and foundry products. W. G. Baker is president; Henry P. Fening, Jr., vice-president; M. E. Brown, secretary; J. N. Baker, treasurer.

The Burke Steel Co., Rochester, N. Y., has been organized as a consolidation of the Rochester Forge Co., Inc., and the Burke Steel Co., Inc., equipment recently installed will more than double the output of the two units. W. H. Kline is president.

The Public Service Co. of Colorado has been organized to acquire the Denver Gas & Electric Co. and the Western L' & Power Co., Boulder, Colo. Plans are under way for the construction of new steel tower transmission lines and generating plants. The new company will have capital stock of $15,000,000 and is an interest of Henry L. Doherty & Co., New York.

The New York Air Brake Co. reports net operating income after interest for the first eight months of 1923 of $2,007,595. President Starbuck reported unfilled orders as of Sept. 1 of approximately $2,225,000, and declared that the outlook was very good. The regular quarterly dividend of $1 per share was declared on common stock.

NEW TRADE PUBLICATIONS

Controller Valve.—Bristol Co., Waterbury, Conn. Bulletin No. 319 of 16 pages is devoted to the Bristol-Fuller controller valve for air and oil, in connection with oil-burning installations and governed by temperature control. Both the fuel and air valves are operated by electric motor and are carefully timed. Automatic recording instruments place their records upon a chart. A variant is a controller valve for air and gas, while still another type handles air, gas, water and steam. A safety-stop valve is used in connection with the equipment.

Filtration for Flue Gas.—Uehling Instrument Co., Paterson, N. J. Bulletin No. 116-A of 8 pages is devoted to the "pyro-porus" filter, and to its use in flue gas analysis. Drying and desulphurizing the gas are given adequate attention, with a final section on gas line tubing. The bulletin tells how ordinary difficulties met in gas analysis may be avoided.

Contractors' Pump.—American Well Works, Aurora, Ill. Bulletin No. 169 describes a centrifugal pump operated by a gas engine through flexible coupling, the unit being mounted on a rigid base about 3 ft. x 17 in. overall. The entire unit measures about 4 ft. 6 in. in length, and 23 in. in width. The pump is recommended for heads up to 57 ft. and delivery from 70 to 250 gal. per min.

Oilstone Tool Grinder.—Oliver Machinery Co., Grand Rapids, Mich. Four-page folder describing No. 585 motor-driven grinder. The machine includes an emery cone, a leather stropping wheel, two oilstone wheels and the tool holder, and stands upon a cast iron pedestal. It is portable, deriving power from any electric light socket. Ball bearings and automatic lubrication make it easy running. The pan measures 25 x 28 in.

Temperature Control Apparatus.—The Bristol Co., Waterbury, Conn. Bulletin No. 319, on its new Bristol-Fuller controller valve for use in connection with temperature control, particularly of interest to those engaged in heat-treating of metals.

Current Metal Prices

On Small Lots, Delivered from Merchants' Stocks, New York City

The following quotations are made by New York City warehouses.

As there are many consumers whose requirements are not sufficiently heavy to warrant their placing orders with manufacturers for shipments in carload lots from mills, these prices are given for their convenience.

On a number of items the base price only is given, it being impossible to name every size.

The wholesale prices at which large lots are sold by manufacturers for direct shipment from mills are given in the market reports appearing in a preceding part of THE IRON AGE under the general heading of "Iron and Steel Markets" and "Non-Ferrous Metals."

Iron and Soft Steel Bars and Shapes

Bars:	
Refined iron bars, base price	3.54c.
Swedish charcoal iron bars, base	7.25c.
Soft steel bars, base price	3.54c.
Hoops, base price	5.19c.
Bands, base price	4.39c.
Beams and channels, angles and tees, 3 in. x ¼ in. and larger, base	3.64c.
Channels, angles and tees under 3 in. x ¼ in. base	3.54c.

Merchant Steel

	Per Lb.
Tire, 1½ x ½ in. and larger	3.60c.
(Smooth finish, 1 to 2½ x ¼ in. and larger)	4.10c.
Toe-calk, ½ x ⅜ in. and larger	4.60c.
Cold-rolled strip, soft and quarter hard	7.50c. to 8.50c.
Open-hearth, spring-steel	5.00c. to 7.50c.
Shafting and Screw Stock:	
Rounds	4.65c.
Squares, flats and hex	5.15c.
Standard tool steel, base price	15.00c.
Extra tool steel	18.00c.
Special tool steel	23.00c.
High speed steel, 18 per cent tungsten	75c. to 80c.

Tank Plates—Steel

¼ in. and heavier	3.64c.

Sheets

Blue Annealed

	Per Lb.
No. 10	4.59c.
No. 12	4.64c.
No. 14	4.69c.
No. 16	4.79c.

Box Annealed—Black

	Soft Steel C. R., One Pass Per Lb.	Blued Stove Pipe Sheet Per Lb.
Nos. 18 to 20	4.55c. to 4.80c.	.....
Nos. 22 and 24	4.60c. to 4.85c.	5.10c.
No. 26	4.65c. to 4.90c.	5.15c.
No. 28	4.75c. to 5.00c.	5.25c.
No. 30	4.95c. to 5.20c.	.....

No 28 and lighter, 36 in. wide, 20c. higher.

Galvanized

	Per Lb.
No. 14	4.85c. to 5.10c.
No. 16	5.00c. to 5.25c.
Nos. 18 and 20	5.15c. to 5.40c.
Nos. 22 and 24	5.30c. to 5.45c.
No. 26	5.45c. to 5.70c.
No. 27	5.60c. to 5.85c.
No. 28	5.75c. to 6.00c.
No. 30	6.20c. to 6.50c.

No. 28 and lighter, 36-in. wide, 20c. higher.

Welded Pipe

Standard Steel			*Wrought Iron*		
	Black	Galv.		Black	Galv.
½ in. Butt..	—41	—24	½ in. Butt..	— 4	+19
¾ in. Butt..	—46	—32	¾ in. Butt..	—11	+ 9
1-3 in. Butt .	—48	—34	1-1½ in. Butt	—14	+ 6
2½-6 in. Lap.	—44	—30	2 in. Lap.....	— 5	+14
7-8 in. Lap..	—41	—11	2½-6 in. Lap	— 9	+ 9
9-12 in. Lap.	—34	— 6	7-12 in. Lap.	— 3	+16

Steel Wire

BASE PRICE* ON No. 9 GAGE AND COARSER	Per Lb.
Bright basic	5.00c.
Annealed soft	5.00c.
Galvanized annealed	5.65c.
Coppered basic	5.65c.
Tinned soft Bessemer	6.65c.

*Regular extras for lighter gage.

Brass Sheet, Rod, Tube and Wire

BASE PRICE

High brass sheet	18 c. to 19 c.
High brass wire	18½c. to 19½c.
Brass rods	15¾c. to 16¾c.
Brass tube, brazed	26 c. to 27½c.
Brass tube, seamless	23 c. to 24 c.
Copper tube, seamless	24½c. to 25½c.

Copper Sheets

Sheet copper, hot rolled, 21¾c. to 22¾c. per lb. base.

Cold rolled, 14 oz. and heavier, 3c. per lb. advance over hot rolled.

Tin Plates

Bright Tin		Coke—14 x 20		
			Prime	Seconds
Grade "AAA" Charcoal 14x20	Grade "A" Charcoal 14x20	80 lb.	$6.55	$6.30
		90 lb.	6.65	6.40
		100 lb.	6.75	6.50
IC..	$12.55	$10.70	IC.. 7.00	6.75
IX..	13.95	12.55	IX.. 8.25	8.00
IXX..	15.55	13.75	IXX.. 9.50	9.25
IXXX..	17.10	15.30	IXXX.. 10.75	10.50
IXXXX..	18.85	16.80	IXXXX.. 12.00	10.75

Terne Plates

8 lb. coating, 14 x 20

100 lb.	$7.00 to $8.00
IC	7.25 to 8.25
IX	8.25 to 8.75
Fire door stock	9.00 to 10.00

Tin

Straits pig	44c.
Bar	49c. to 56c.

Copper

Lake ingot	16¾c.
Electrolytic	16¼c.
Casting	16 c.

Spelter and Sheet Zinc

Western spelter	7¾c.
Sheet zinc, No. 9 base, casks	10½c. open 11c.

Lead and Solder*

American pig lead	8¼c. to 8¾c.
Bar lead	11c. to 12c.
Solder ½ and ½ guaranteed	31c.
No. 1 solder	29c.
Refined solder	25c.

*Prices of solder indicated by private brand vary according to composition.

Babbitt Metal

Best grade, per lb.	75c. to 90c.
Commercial grade, per lb.	35c. to 50c.
Grade D, per lb.	25c. to 35c.

Antimony

Asiatic	9c. to 9½c.

Aluminum

No. 1 aluminum (guaranteed over 99 per cent pure), in ingots for remelting, per lb.	34c. to 35c.

Old Metals

Business continues quiet although values are a little firmer. Dealers' buying prices are nominally as follows:

	Cents Per Lb.
Copper, heavy crucible	11.75
Copper, heavy wire	11.25
Copper, light bottoms	9.50
Brass, heavy	6.25
Brass, light	5.00
Heavy machine composition	9.00
No. 1 yellow brass turnings	6.50
No. 1 red brass or composition turnings	7.75
Lead, heavy	6.00
Lead, tea	5.00
Zinc	4.25
Cast aluminum	15.00
Sheet aluminum	15.00